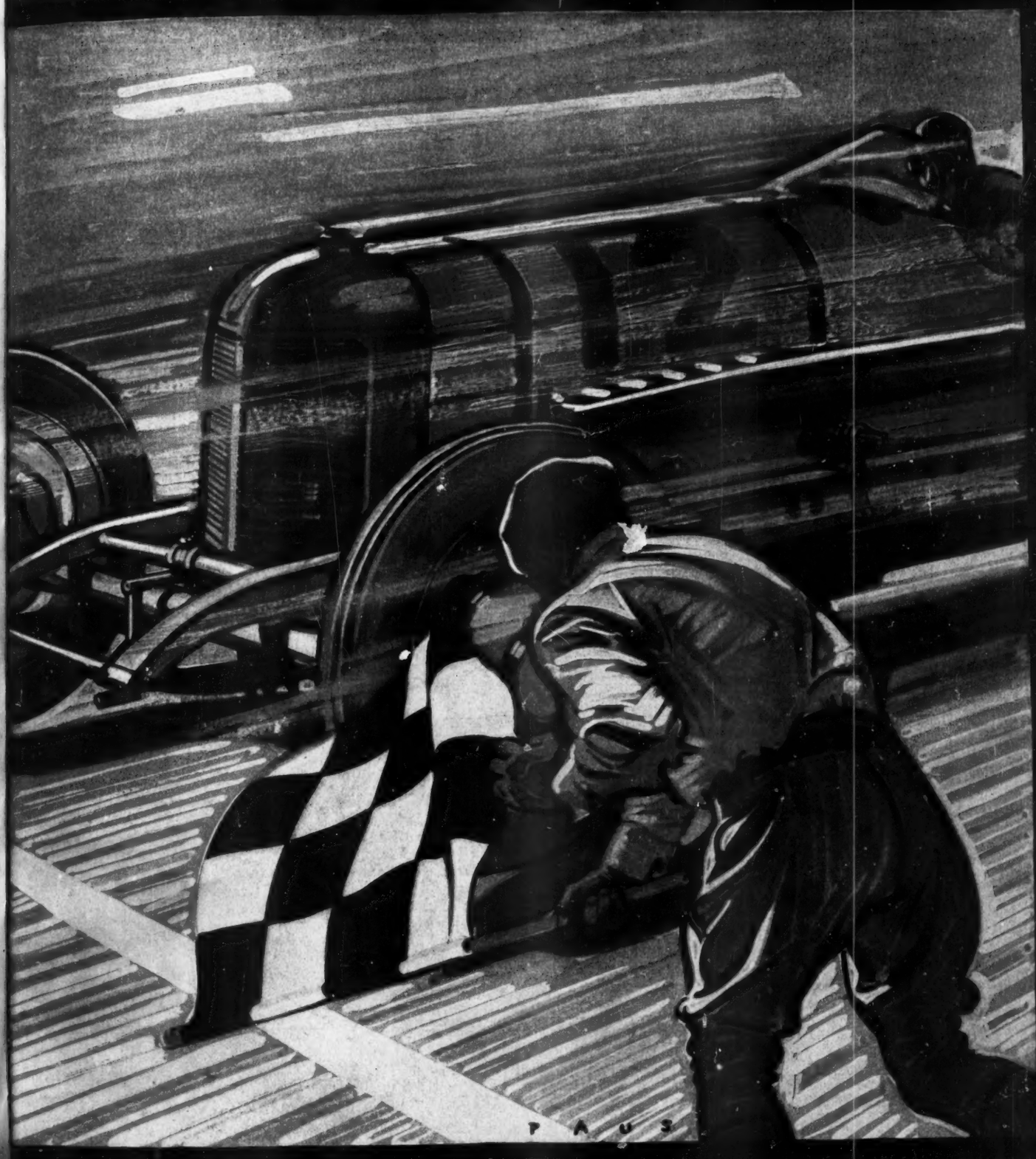
Popular Science

MONTHLY



Doing the kind of work that a fine tool does

Why do slowly by hand what a Millers Falls Electric Drill does so much easier, quicker and better? This fine, powerful tool bites through any material without laying against it—wood, steel, building tile, cement, all the same. You can't do by hand the quality of work that you get with this electric tool.

If you always want to be sure of the standard of work that a fine tool produces, better drop in at the hardware store where you trade and "heft" this Millers Falls drill. It is light but strongly made, with a fine balance which any good judge of tools will know at once.

Specifications: Portable Electric Drill No. 414

MOTOR, Universal—operates on D. C., or on A. C., up to 60 cycles · SPEED, No load 1800 R. P. M. 1.2 Amps · CAPACITY, 0-¼ in. in steel, 0-⅛ in. in cast iron, 0-⅜ in. in wood · Furnished for 110 or 220 volts · Jacobs heavy duty chuck · Heat treated alloy steel gears · Ball thrust bearing on spindle · Armature mounted on high grade ball bearings · Automatic switch mounted in handle · Armored attachment plug · Aluminum housing efficiently ventilated · Pig-tail brushes (not usually found in drills of this size), easily replaced from outside without taking tool apart · Grease lubrication throughout · 8 feet best quality rubber covered cord furnished · Spindle offset for close boring—1⅛ in. from outside of housing · Weight 5½ lbs. net · Overall length 12 in. · Packed one in a heavy corrugated box · PRICE : 110 Volts, $30.00.

MILLERS FALLS TOOLS
SINCE 1868

MILLERS FALLS COMPANY
NEW YORK, 28 WARREN STREET

MILLERS FALLS, MASS.
CHICAGO, 9 SOUTH CLINTON STREET

POPULAR SCIENCE MONTHLY

Table of Contents

Index to the issues from

JULY TO DECEMBER

1927

WHAT IS NEW THIS MONTH

Table of Contents for July

LEADING ARTICLES

WIRELESS POWER—THE NEXT GREAT INVENTION 9
By Alden P. Armagnac
Will radio and earth currents soon run the world's engines?

HOW FLOODS CHALLENGE SCIENCE . . . *By Edgar C. Wheeler* 18
What science has learned from a great disaster

THE LARGEST PACKAGE EVER SHIPPED 20
The story of a remarkable engineering feat

CANNED FOOD AND YOUR HEALTH . . . *By Thomas M. Johnson* 21
An informative article on the diet question

STOCK CARS TESTED IN REAL RACES . . *By Joseph S. Edgerton* 23
How speed trials point the way to better automobiles

A NEW ERA OF HUGE BRIDGES . . . . . *By Orville H. Kneen* 24
A famous engineer tells why men now can build mile-long spans

COURIERS THAT NEVER FAIL . . . . . *By Jack O'Donnell* 26
Why the tireless homing pigeon is man's valued friend

WHAT GAME DO YOU PLAY? . . . . . *By Arthur Grahame* 27
A discussion of the "danger age" in sports

BRONCHO-BUSTERS OF THE AIR . . . . . *By Cy Caldwell* 29
What happens when a test pilot tries out a new plane

GLENN CURTISS SEES A VISION OF AVIATION'S FUTURE 32
Reported by Frank Parker Stockbridge
Startling predictions by a pioneer birdman

UNCLE SAM'S TOY COAL MINE . . . . . *By M. E. Clements* 36
Where Government scientists test mining hazards

HIS STRANGE WORLD CAME TRUE . . . . . *By Don Knowlton* 37
How modern wonders vindicate Jules Verne's amazing prophecies

SAM LOYD'S PUZZLE PAGE 65

IS YOUR HOUSE TOO HOT OR COLD? . . *By John R. McMahon* 66
New discoveries about the uses of insulation

STOP THE NOISES IN YOUR CAR . . . . . *By Martin Bunn* 69
Gus and Joe tell how to trace rattles and squeaks

THE ADVANTAGE OF GROUP MANAGEMENT TO THE PUBLIC UTILITY INVESTOR . . . . . *By Wallace Ames* 4

WHAT IS A GOOD LATHE? . . . . . *By Carlos de Zafra* 6

FICTION

CHIEF OF BATTALION . . . . . *By Karl W. Detzer* 14
The thrills and science of fire-fighting portrayed in a graphic story

BARE HANDS—PART 5 . . . . . *By Hawthorne Daniel* 40
A gripping novel of man's conquest of Nature

RADIO

PERFECT "A" CURRENT FOR YOUR RADIO . . *By Alfred P. Lane* 61

YOU NEED A LIGHTNING ARRESTER . . *As told to Newton Burke* 63

THE HOME WORKSHOP

HOW TO APPLY ART TRANSFERS . . . . . *By Berton Elliot* 73

BUILDING A CORNER CLOSET . . . . . *By Everett Eames* 74

HINTS ON USING TAPS AND DIES . . . . . *By F. S. Browning* 78

Automobiles

A Highway on the Roof Tops . . 43
Tests Autoist's Footwork . . . 44
Ignition Hints for Your Car . . . 44
New Auto Motor 46
"Taxis" Old and New in the Sahara 48
Theater Teaches Traffic Laws . . 49
Odd Cycle-Auto Solves Gas Problem 51
Rollers for Grade Crossings . . . 53
Measure Auto Seat's Bumps . . 55
Novel Siphon Starter 68
Screen Your Car 68
Switch to Control Generator . . 68
Pedal Extension Easy to Build . . 68
A Table for the Auto Lunch . . 68
Rope Luggage Carrier 68

Aviation

Fly Own Gliders in Novel Club . . 13
Trans-Ocean Airmen Crash in Test Flight 13
A Triple-Purpose War Plane . . 45
French Build "Ghost" Plane . . 47
Our First Ocean Air Liner? . . . 52
Germans Have Flying Yacht . . 53

Exceptional People

He's America's Orchid King! . . 39
She Makes Bike Tires 46
Makes Table of 51,000 Parts . . 46
He "Clocks" the Big Races . . . 47
Lumberman Models Forest Creatures in Wood 47
To Cross Ocean in Sailboat . . . 47
Loops the Loop in Auto 49
Commands Arctic Ship 54
Uses Homemade Diving Helmet . 55
He Makes Intricate Glass Apparatus 55
Girl Daredevil Rivals Men . . . 56

Health and Hygiene

What Your Nervous System Looks Like 34
Does a Permanent Wave Harm Your Hair? 34
How Do You Sleep? 35
Soap as a Germ-Killer 48
Deaths from Heart Disease . . . 49
Healing with Music 51
Salt "Peps Up" Miners 52
Don't Listen with Your Eyes . . 52
New Diabetes Remedy Replaces Insulin 53

July, 1927, Vol. 111, No. 1. **Popular Science Monthly** is published monthly at 250 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Chicago, Illinois. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1927, by the Popular Science Publishing Co., Inc. Single copy, 25 cents. Yearly subscriptions to United States, its possessions, and Canada, $2.50; foreign countries, $3. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, **Popular Science Monthly** does not underwrite the business methods of the individuals or concerns producing them. The use of **Popular Science Monthly** articles for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

In This Single Issue We Publish More Than 250 Articles Depicting the Latest Achievements and Discoveries in the World of Science and Invention

Students Take Poison in Test . . 54
How Does Noise Affect a Typist? . 54
Blood 1/20 of a Man's Weight . . 57

Laboratory Discoveries

A New Electric Insulator . . . 34
Earth's Bulgings Studied . . . 34
Ethylene as a Fruit Ripener . . 34
Cathode Rays Dry Paint Oils . . 35
Engineers Study "Cold Light" . . 35
Whitewashes Defy Heat 45
Test Machines in "Padded Cell" . 49
Science Explains "Bloody Rains" . 49

New Processes and Inventions

It Sees through Darkness and Fog. 12
New Microscope Lamp 35
Pullmans Substitute Bedrooms for Berths 39
Electric Hole Saw 44
It Measures Furnace Heat . . . 44
Shows When Gas Is Poor . . . 44
Ingenious Combination Tool . . 45
Three Lanterns in One! 45
Blocks Improve Acoustics . . . 46
Paper from Old Dollar Bills . . 46
Cutting Steel with Iron 47
Novel Device Compares Fingerprints 50
New Ultra-Violet Lamp Detects False Gems 50
Colored Lights Teach Piano . . . 50
Life Preserver Instantly Inflated . 51
New Fire Engine Uses Soap Suds . 51
Machine Tests Boxer's Punch . . 52
Tobacco Chemically Made . . . 52
"Eraser Key" Aids Typists . . . 53
Vise Holds at Any Angle 53
Odd Apparatus Produces "New Music" 54

New Devices for the Home

A Furnace That Feeds Itself . . 46
Are You Planning to Buy an Oil Burner? 56
New Fork Has Automatic Ejector . 58
Oversize "Tea Ball" Cooks Rice . 58
Cup-Size Egg Beater 58
Wide-Rim Pie Plate Can't Spill Juice 58
Candy Making Instrument Set . . 58
Versatile Traveling Iron 58
Metal Ring Saves Gas 58
New Cake Pan Has Window . . . 58
A Bath for Your Razor Blades . . 59
New Electric Mixer Saves Work . 59
Electric Dishwasher Has Large Capacity 59
Rolls Out Doughnuts 59
Automatic Safety Iron Stand . . 59
An Unusual Electric Fan for Your Table 59
Card Table Folds by Single Leg . . 59
Electric Range Runs Automatically 59

Photography

Send Color Photos by Wire . . . 34
Movies That "Live" 44
Stomach Can Be Photographed . . 49
Lessens Movie Film Breakage . . 52
"Movies" Preserve County Records 64

Radio

Broadcasting from Balloons . . . 35
New York's Storm Detector . . . 45
World's Biggest Vacuum Tube . . 46
"Mystery" Burglar Alarm . . . 47
Has Radio Wave All to Himself . 55
How to Choose Condensers . . . 60
Be Sure to Have a Good Ground . 60
A B C's of Radio 60

Unusual Facts and Ideas

Blowing Up a Mountain 12
Six Hundred Foot Leap by Balloon Jumper 12
Whippet Beats a Race Horse . . 12
World's Largest Submarine . . . 12
Firemen Test Water Pressure 500 Feet above Street 13
A Motor "What-Is-It" 13
Traffic Cops of Other Lands . . 30
The Story of a Baseball 31
Smoke War On in New York . . 34
U. S. Sends Most Telegrams . . 34
Cat Has Nerves Extracted . . . 35
Wealth Wasted in Lightning . . 35
Houses of Rammed Earth . . . 44
Gold Plucked from Air 45
Is Quiet Necessary for Good Golf? . 48
Ice Lowers 16-Ton Floor . . . 48
Armor for Matador's Horse . . 48
Brushes from Chinese Pigs . . . 48
To Remove Unwanted Grass . . 48
Salt Lake Changes into Fresh . . 48
Staging a Deer Rodeo 49
Ship Plastered with Oysters . . . 49
Deposits by Chute in Burglar-Proof Bank 50
Carries His Own Breeze 50
Biggest Crane Afloat 51
"Smell-Meter" to Fight Bugs . . 52
Music Sets Off Powerful Explosive . 52
Gyroscope for Giant Yacht . . . 52
Find Mummy in Ohio Cave . . . 52
Puncture Vine Spreads East . . 53
Industry Now Uses Garnet . . . 53
Recording Languages for Posterity . 55
Falling Meteor Misses Cyclist . . 56
Male Birds Hatch Eggs 56
"Wheel of Seven Sad Sounds" . . 56
You Can't Tell 'Em Apart . . . 56
Six Musical Instruments in One! . 56
A Diamond Rush in Action . . . 57
New Depths for Oil Wells . . . 57
Doll's House in Match Box . . . 57
Sixteen-Ton Bridge Holds Sixty-Ton House 57
U. S. Phones England a Sample Toot 57
Building Largest Map a Giant Task 64

Hints for the Mechanic

Holder for Small Taps Made from Auto Valve. 104
A Small Shop Method for Tapping Nuts Quickly 104
Inside Calipers Serve as Surface Gage in Emergency 104
An Angle-Iron Timber Hanger . . 104
Why a Tap Breaks 105
Measuring Angles with Extreme Accuracy 105
What Causes Chatter Marks . . 105
How to Use a Diamond for Trueing Grinding Wheels 105
Guard for Tapeline Case Made from Old Inner Tube 105
Pocket First Aid Kit Goes in Small Razor Case. 106
Expanding Chuck for Use in Finished Holes. 107
Substantial Horse for Shop Use Made of Iron Bars. 107
Grinding Chucking Reamers . . 107
How to Straighten Hardened Parts 108
Using Micrometer to Measure Work with Concave Face 108
Sheet Metal Holder Keeps Acid Bottle from Spilling 108
Lengthening Short T-Bolts. . . . 108
Using Twin Angle Plates to Mount Lathe Work 109
Soft Jaws for Lathe Chuck. . . . 109

Ideas for the Handy Man

A Driveway for Your Garage . . 75
Swinging Seat for Campers. . . 76
"Tuckaway" Canvas Bed 76
How to Make a Fire-by-Friction Set 76
Airplane Weather Vane. 76
Rowboat Anchor for Fishermen . 76
Hammering Out a Porch Lantern . 81
Replacing Jackknife Handles . . 82
Rubber Cement Mends Torn Hunting Coat Invisibly. 82
Gimlet Bit Serves as Pipe-Cleaner. 82
Flaming Letters Light Camp . . 84
Ground Glass Substitute Easily Made 85
Building a Sturdy Porch Swing . 86
Tiny Decorative Galleon Has Walnut Shell Hull 87
How to Lock a Dial Telephone Against Unauthorized Use . . 87
Painted Glass Checkerboard . . 89
Oversize Glueing Clamps . . . 89
A Square Peg in a Round Hole. . 90
How to Solve the Popular Science Block Puzzle 90
Tool Rack of Pipe Straps . . . 90
Blueprints for Your Home Workshop. 91
Roman Candle Propels Fireworks Barge 93
High Power Fruit Press Made with Auto Jack and Rim 93
Our Viking Ship Model 94
Aerial Top Made with Spools and Clothespin 96
Acetone in the Home Workshop . 97
How to Make a Paneled Chest. . 98
Sturdy Toy Glider Folded from Letter Paper 99
C-Clamp Made from Large Nut . 99
Neat Wooden Stand Holds Watch at Night. 100
How to Grind Smooth Holes Through Plate Glass. 100
Window "Curtains" for Garage . 101
Convenient Gate Latch. 101
How to Take Care of Paint Brushes. 102
Preserving Large Corks. 103

WHAT IS NEW THIS MONTH

Table of Contents for August

LEADING ARTICLES

WHY WE MAY WAIT TWENTY YEARS FOR OCEAN AIR LINES . . . 9
By Commander Richard E. Byrd, U. S. N.
An expert's view of future commercial sea flights

LINDBERGH'S GREAT PARTNER . . . *By Frank Parker Stockbridge* 12
Details of the first New York-to-Paris plane

THE FIRST PLANE TO GERMANY . . . . *By George Lee Dowd, Jr.* 14
Interesting Predictions by Aviation Authorities

LIFEBOATS UNDER THE SEA . . . . . *By Alden P. Armagnac* 15
An inventor's amazing plan to make submarines safe

ON THE SEA IN A CABLE SHIP . . . . . *By Edgar C. Wheeler* 22
Thrills in the lives of the "ocean linemen"

A $10,000,000 "ACCIDENT" . . . . . *By Kenneth Wilcox Payne* 24
The remarkable story of an unusual personality

EACH OF US HAS FORTY SLAVES . . . . . *By Robert E. Martin* 26
Do you realize what you owe to electric power in your daily life?

HOPE FOR HAY FEVER VICTIMS . . . . . *By Norman C. McLoud* 27
How recent medical discoveries yielded a new treatment

STRANGE ANTS GROW FLOWERS . . . . . *By Hyatt E. Gibson* 29
What a noted biologist discovered in the jungle

EVEN WORMS SOLVE PUZZLES . . . . . *By Prescott Lecky* 33
Watching "dumb animals" think

NEW THRILLERS DEFY GRAVITY . . . . . *By Elwell Crissey* 38
A revelation of the engineering skill that goes into amusement devices

DECK FANS TO AID SEA FLYERS 43
A Swiss engineer's ingenious scheme for mid-ocean airplane landings

SAM LOYD'S PUZZLE PAGE 65

IS YOUR HOME SAFE FROM FIRE? . . . . *By John R. McMahon* 66
Some valuable hints on protecting your dwelling

WHEN YOUR MOTOR SIZZLES . . . . . *By Martin Bunn* 69
Gus and Joe give timely advice on summer overheating

DO YOU KNOW THE TRUTH ABOUT OIL BURNERS? 6

HOW YOUR ELECTRIC TOASTER HELPS PAY PUBLIC UTILITY DIVIDENDS . . . . . *By Wallace Ames* 4

FICTION

WHIRLING WHEELS—PART I . . . . . *By Edmund M. Littell* 18
The birth of the automobile told in a fascinating new novel

BARE HANDS—CONCLUSION . . . . . *By Hawthorne Daniel* 40
The swift climax of an absorbing tale of the North

RADIO

HOW TO HOOK YOUR PHONOGRAPH TO THE RADIO SET 62
By Alfred P. Lane

CONTROLLING RADIO VOLUME . . . . . *By John Carr* 64

THE HOME WORKSHOP

A SHIP-MODEL VANE . . . . . *By Capt. E. A. McCann* 73

LINDBERGH'S PLANE, TOY SIZE . . . . . *By D. M. Clayton* 76

CUTTING THREADS ACCURATELY . . . . . *By Charles Kugler* 80

Automobiles

Briton Develops Cheap Fuel . . 44
Soft-Faced Hammer Saves Your Car 44
When You Drive Your Car Around a Corner 44
Movies Test Auto Drivers . . . 46
Mud No Terror to This Car! . . 48
R. R. Gates Direct Traffic . . . 48
Twin Engines Drive Novel Bus . . 48
Amazing Car Turns in Its Own Length 50
Odd Electric Car for Shopping . . 51
Light Signals Auto Speed . . . 53
Keeping Auto Curtains from Flapping 68
Whistle Indicates Boiling . . . 68
New Battery Terminal Tool . . 68
A Simple Spring Oiler 68
An Emergency Hose Clamp . . 68
Spiked Board Pulls You Out . . 68

Aviation

New Motor Balloon 16
Gyroscope Stabilizer for Airplane . 16
Testing Helicopter Model . . . 17
Plane Hauls Glider in Aerial Train . 32
"Superpower" for Airplanes . . 49
"Wing Flutter" Wrecks Planes . 52
Ingenious Device Tests Air Pilot's Vision 54
Glider Soars Fourteen Hours . . 54
New "Booster" for Airplanes . . 57

Health and Hygiene

Eyeglasses and Efficiency . . . 37
New Disease from the West . . 37
Blueberry Cure for Diabetes . . 47
Aid for Deaf Has Tone Control . 47
Water Purified by Rays 48
"Dust Mask" Guards Against Contagion 51
Hums You to Sleep 51

Laboratory Discoveries

Oil Ships and Rainfall 36
Sash Cords Tested at Bureau of Standards 36
Can Rays Produce Life? 37
That Mythical "Sea Level" . . 49
Artificial Light Speeds Up Beets . 49
Test Cigarette Fire Danger . . . 52
Sounds That Kill 53
Dark Rubber Lives Longer . . . 53
The Speed Limit of Vision . . . 54
Tin Not Harmful 56
Why Your Watch Slows Down . . 57
Gas Appliances Made Safer by Laboratory Tests 60

Models

Tiny Whaling Ship for Movies . . 31
Model Building in Cork 31
Midget Locomotive That Runs . . 31

August, 1927, Vol. 111, No. 2. **Popular Science Monthly** is published monthly at 250 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Chicago, Illinois. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1927, by the Popular Science Publishing Co., Inc. Single copy, 25 cents. Yearly subscriptions to United States, its possessions, and Canada, $2.50; foreign countries, $3. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, **Popular Science Monthly** does not underwrite the business methods of the individuals or concerns producing them. The use of **Popular Science Monthly** articles for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

More Than 250 Striking Articles in This Single Issue Cover from Every Angle the Latest Developments in the World of Invention and Discovery

Carved Figures Depict Famous Battle 31
Schoolboy Constructs Miniature Auto 31
Small-Scale Railway in His Back Yard 31
Models for Flood Prevention . . 37
Miniature Stage Tests Lights . . 55
Factory Ventilation Studied with Model 56
Rubber for Ship's Crosstrees . . 79
Ship Models Built from Our Blueprints 108

New Devices for the Home

Safety Guard for Your Iron Cord . 58
Detachable Edge Keeps Knife Sharp 58
Shears Corn from Cob 58
Novel Glass Teapot Has Handy Ball . 58
Pad Protects Your Ironing Board . 58
New Asbestos Iron Stand 58
Novel Washer Operates by Suction . 58
"Heat Domes" Cook with Gas Turned Off 58
Fish Clamp Makes Scaling Easy . 59
Adjustable Glove Drier 59
An Iron You Don't Lift 59
New Grapefruit Tool 59
Keeps Moths from Your Clothes . 59
"Holder for Holders" on Gas Range 59
Drying Rack Clamps on Radiator . 59
Removes Vegetable Seeds and Skins 59

New Processes and Inventions

Life-Saving Suits for Harbor Firemen 16
France Tries Iron Roads 44
New Device Rectifies Current . . 44
Odd Oil-Burning Locomotive . . 45
Houses Washed by Machine . . 45
Ten-Pound Electric Handsaw . . 45
Magnet Saves Worker's Eyes . . 46
Electricity Hastens Crops . . . 46
Flame Burns Under Water in New Boiler 46
Portable Reading Lamp Holder . 47
Map Puzzle Teaches Geography. . 47
Wooden R. R. Ties Passing . . . 47
"Ultrawhistle" Gives Silent Summons 47
Auto's Exhaust Heats Coffee Pot . 49
Lunch Kit and Table in One . . 49
"Ear Lorgnette" for Theater . . 50
Automatic Fisherman Reels Them In. 50
Hat of a Dozen Shapes 50
Clock Controls Electric Lights . . 50
Saw Guide Replaces Miter Box . . 50
Live-Saving Suit Resembles Diver's Costume 51
Mechanical Smoker Breaks In Pipes 51
High-Speed Marker Lays Traffic Lines 51
Overheated Engine Stops Itself . . 52
Signal Stops This Elevator . . . 52
A New Way to Open Letters . . . 53
Drill Carries Its Own Motor . . 54
New Paint Stops Oil Leaks . . . 54
Warns of Dangerous Fumes . . . 55
"Touchy" Electric Cable Traps the Burglar 55
Tests a Tipplers' Breath 56
Strange New Liquid Makes Wood Fireproof 56
Space-Saving Gas Mains Shaped like Planks 57
Liquefied Gas for Fuel 57
Manless Tractor Plows without Steering 60

Photography

$2,000,000 Offered for His Picture Invention 16
Cop Invents Anti-Burglar Camera . 17
New Camera Faster Than Lightning 37
Feeds Movie Film at High Speed . 48
Portable Arc Lamp Aids Amateur Movie-Makers 50

Radio

New Radio Beacon 32
"Radio Watchman" Guards Ohio Reservoir 32
Hunting Treasure by Wireless . . 45
Radio Lights to Guide Airmen . . 46
Weather Maps by Radio for *Los Angeles* 52
Hides Antenna in Ship's Hull . . 54
"Radio Roof" 100 Miles Up . . 54
New Ideas for Chargers 61
Static Still Unconquered 61
Keep Tube Prongs Clean . . . 61
Heat Spoils Dry Cells 61
C-Voltage for Power Tubes . . . 61
A B C's of Radio 61

Ships

Destroyers Ready for Scrap Heap . 16
Most Powerful Fireboat 17
"Old Ironsides" Comes Back . . 30
Destroyer Her Own Dry Dock . . 30
Like a Fly in a Sugar Bowl . . . 30
"Black Fleet" Fails to "Capture" New England 30
Repairing a Superdreadnaught . . 30
Britain's New "Mystery Ship" . . 30
Monster Warship Aground . . . 30
Modern Hospital Sails with Fleet . 35
Largest Oil Burning Ship to Have No Funnels 55

Unusual Facts and Ideas

Moving a 350-Foot Front . . . 17
Man Was Never an Ape 35
Telephones from Ocean Bed . . . 36
Treasure from the Dead Sea . . 36
Metered Fuel for Homes 36
Re-Create Indian Salt Mine . . 36
Giant Testing Machine 36
Rebuilding a Whale 37
Faraday's Coil Brought to America . 37
Traffic Tower in a Hotel 44
Counting Cash by Electricity . . 45
Artificial Heat for the Ocean . . 46
Largest Dredge for New York's Bridge 47
How Apes Might Talk 47
Building Stone Waterproofed . . 48
Speeding Up the Chariot Race . . 49
More Power from Less Coal . . . 49
Coaling a Locomotive in Four Minutes 52
Aerial Car Paints High Electric Cable. 53
Mammoth Tool Bores 13-Foot Cylinders 53
To Hush Riveters 54
"Perpetual Motion"—Almost . . 55
Twins' Minds Run Alike . . . 55
Building Mammoth Generator . . 55
Measuring Niagara's Power . . . 55
X-Rays Ferret Out Rum. 56
Hottest Spots on Earth 56
Seventy Million Phone Calls a Day 56
A Deep-Sea "Butterfly Net" . . 56
Valuable New Mineral Found in Vast Deposit 57
Canal Runs through Five-Mile Tunnel 57
Plaster Statues Made Bronze . . 57

Hints for the Mechanic

New Machines Aid Mechanics . . 102
Diamond Holder for Surface Grinder 103
Installing Leather Packing . . . 103
Piece of String Solves a Tapping Problem 103
Non-Removable Rivets for Small Plates 104
Working Cast Iron on the Lathe . . 105
Oiled Reamer Bores Smaller . . 105
Compound for Chasing Threads . 105
Oiling Hints 105
Soap Serves as Cutting Compound, Cools Bearings 105
Pliers Adapted for Knurling . . 105
Milling Odd-Width Narrow Slots . 105
Holding Short Pins Vertically . . 107

Ideas for the Handy Man

Kitchen Table Serves As Bench . 75
How to Mix White Lead Paint . . 75
Lindbergh's Plane, Toy Size . . 76
Timesaving Mail Box Has Hinged Bottom 77
A Plug That Fits Three Holes . . 77
Constructing an Egyptian Type Stool 78
A Hall Mail Rack Easy to Build . 78
How to Make a Teakwood Tea Tray Table 78
Toy Glider Made with Feathers . 79
Archers Can Make Own Targets . 82
A Real Home for Your Dog . . . 84
Adapting a Carpenter's Level for Testing Inclines. 84
Hiding Defects in Woodwork . . 84
Varnishing Glass 85
How to Do Wrought Ironwork . . 86
Blueprints for Your Home Workshop 87
Building a Sand-Box Play Shelter . 88
Cement for Filling Cracks . . . 88
Patching a Shingled Roof . . . 89
Stopping a Water Leak 89
Liquid Metal Polish 89
Solving Your House-Painting Problems 90
Rebuilding a Transmission . . . 92
Bench Vise Helps Clamp Glued-Up Work 93
To Bore a Flat Steel Spring . . . 93
How to Make a Paneled Chest . . 94
How to Fix a Noisy Electric Motor . 98
Pine Cone and Feathers Make Tiny Peacock 98

WHAT IS NEW THIS MONTH

Table of Contents for September

LEADING ARTICLES

AMERICA TAKES TO THE AIR . . . *By Frank Parker Stockbridge* 9
Strides we are making toward "sky traffic"

OUR SUN IS SHRINKING! . . . . . *By Arthur A. Stuart* 17
Latest discoveries of our solar neighbor's secrets

COULD AIR INVADERS DESTROY US? . . . *By Caleb Johnson* 18
A startling picture of a future war terror

HOW ANIMALS MAKE LOVE . . . . . *By Elwell Crissey* 20
Strange mating ways of odd creatures

BLASTS THAT SAVED A CITY . . . . . *By Orville H. Kneen* 21
Wonderful new uses of dynamite

NEXT WE'LL SEE TO PARIS . . . . *By George Lee Dowd, Jr.* 23
Plans of a "television" pioneer to span the Atlantic

WHY WE MOB HEROES . . . . . *By A. A. Brill* 24
A psychologist's remarkable disclosure of the reason we hail "supermen"

PLOWS A THOUSAND ACRES A DAY . . . *By Wheeler McMillen* 27
Mechanical wonders of an up-to-date farm

HE TRAPPED THREE BANDITS WITH A MICROSCOPE! 29
By Edwin Ketchum
How chemistry aided a thrilling man hunt

WHAT'S AT THE TOP OF THE SKY? . . . *By Alden P. Armagnac* 30
Sensational air dashes into the greatest unexplored region of all

WHEN NEPTUNE SCOWLS . . . . . *By Jack O'Donnell* 35
Queer misadventures of ships at sea

$10,000,000 WAR ON WORMS 40
A glimpse of a nation-wide struggle with the devastating corn borer

AIRPLANES 2,000 YEARS OLD! . . . . . *By H. C. North* 41
Remarkable "modern" devices used by ancient priests

TO EUROPE BY ROCKET 43
An amazing airship that could cross the ocean in ninety minutes

WHAT EVERYONE ASKS ABOUT FLYING 62
Answers to familiar but little-understood aviation queries

SAM LOYD'S PUZZLE PAGE 65

A HOUSE WITH 30 SERVANTS . . . . *By John R. McMahon* 66
Modernizing your home with electricity

SOME FINE POINTS OF VALVE GRINDING . . *By Martin Bunn* 69
Gus and Joe discuss an "easy" job

DID YOU EVER *See* TONE QUALITY? 6

WHY PUBLIC UTILITIES ARE A GOOD INVESTMENT 4
By Wallace Ames

FICTION

SCHEDULE OR— . . . . . *By Leo F. Creagan* 14
A thrilling story of an express train's race against time

WHIRLING WHEELS—PART 2 . . . . *By Edmund M. Littell* 32
An unusual novel of the automobile's invention

RADIO

TRICKS OF THE RADIO QUACKS . . . *By Alexander E. Senauke* 63

THE HOME WORKSHOP

NEW WAYS TO PAINT FURNITURE . . . . . *By Berton Elliot* 73

HOW TO BUILD A B-ELIMINATOR . . . . *By Alfred P. Lane* 74

SYSTEM IN SURFACE GRINDING . . *By Hector J. Chamberland* 78

Automobiles

Illuminating Gas for Your Car? . 39
Wheel Operates Car Lights . . . 44
A Motorist's Rocking Chair . . 45
Sight-Seeing Bus Has Balcony . . 45
Baggage Car for Your Auto . . . 45
Your Car's Brakes 47
Motors Race to Garage Roof . . 52
Electric Brakes for Autos . . . 53
"Sidecarette" Carries Three . . 58
Headlight Utility 68
Old Tube Holds Luggage . . . 68
A Wheel Puller 68
Protection against Thieves . . . 68
Wire Loop Holds Screw 68

Aviation

Flying Safety Increases 38
Super-Beacon for Chicago . . . 45
Radio Beacons Guide Airmen . . 48
"Balloon Bicycle" Invented . . 52
A "Flying Doughnut" 52
Plans Plane to Fly Forward, Backward, Up or Down 59
Flyer Takes His Car Along . . . 59

Exceptional People

Takes Notes beneath the Sea . . 12
Steel Magnate Plows Own Farm . 12
Smallest Grandfather in the World? 13
Making Gigantic Statue of Christ . 13
Prepares Cheap "Platinum" . . . 30
Mimics Wood with Concrete . . 48
Gets Medal for Purest Insulin . . 50
Man Races Horse. 53
"Hops Off" from Surf Board . . 53
Makes Clock Case of 5000 Pieces . 55
Build Their Own Speed Boat . . 55
He Made Himself an Automobile . 55

Health and Hygiene

New War on Heart Disease . . . 39
Perspiration Causes Weight Loss . 44
Lights Show Inside of Eye . . . 45
Heart Murmurs "Tuned-In" . . 58
Refutes Attack on Oatmeal . . . 57
Wakes Up Sleeping Muscles . . 57
Manikin Teaches Posture . . . 59

Laboratory Discoveries

Frauds Bared by Strange Detective Rays 37
Test Plants with Ultra-Violet Light . 38
Engineers Check Earth's Slip . . 39
Every Atom a Flashlight . . . 39
Approaching Synthetic Life . . . 39
Fingerprint Records on Skin . . 44
Poison Ivy Antidote Found . . . 44
"Armor" of Germ Analyzed . . . 45
What the Moon Is Made Of . . 46
Squirrel's Memory Tested . . . 50
Charts Predict Track Record . . . 51
Bricks Are Now Tested by Their Ring 53

September, 1927, Vol. 111, No. 3. **Popular Science Monthly** is published monthly at 250 Fourth Avenue, New York, N.Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Chicago, Illinois. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1927, by the Popular Science Publishing Co., Inc. Single copy, 25 cents. Yearly subscriptions to United States, its possessions, and Canada, $2.50; foreign countries, $3. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, **Popular Science Monthly** does not underwrite the business methods of the individuals or concerns producing them. The use of **Popular Science Monthly** articles for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

A New X-Ray Discovery . . . 56
Germs Give Light 57
Uranium Aids Growing Crops . . 57
Only Four Basic Odors 59

Models

Models Show Earth's Buckling . . 38
A Skyscraper of Glass 50
Builds *Old Ironsides* 54
Lawyer's Hobby Repairing Old Ship Models 54
A School for Ship Modeling . . . 54
Ship Replicas Their Business . . 54
Makes "Spanish Galleon" 54
Model Yacht Tests Odd Design . 54
Electric Motor Drives Baby Plane . 55
Making Blocks for Ship Models . 105
Ship Models Built from Our Blueprints 108

New Devices for the Home

Gravity Operates This Salt-Shaker . 60
Unusual Coffee Pot Has Strainer in Lid 60
Automatic Heat Control for Iron . 60
Combination Salt and Pepper Shaker 60
Makes Your Candlesticks Electric . 60
New Tongs Save Your Hands . . 60
Double Fork Picks Up Hot Things 60
Odd Ladle Drains Vegetables . . 61
A Percolator You Can Take Apart . 61
Peels Oranges with Two Motions . 61
Space-Saving Refrigerator Dishes . 61
Sanitary Waste Receptacle . . . 61
A Picnic Container for Seasoning . 61
One-Hand Serving Utensils . . . 61
Prongs Keep Your Pictures Straight 61
Toasts Four Slices at Once . . . 61

New Processes and Inventions

Latest Armored Car Charged with Electricity 13
Matching Colors by Machine . . 38
Boards from Lumber Chips . . . 39
Machine Fights Forest Fires . . 44
Builds Diving Motor Boat . . . 46
Vibrating Bed Woos Sleep . . . 47
Mask Saves Pugilist's Face . . . 47
Clock Like Speedometer 48
Device Indicates North Star . . . 48
A Razor-Blade Lawnmower . . . 48
Folds 5000 Letters an Hour . . . 48
Fertilizer Applied by Hose . . . 49
Canoe Built of Paper 49
Saves Gold for Dentists 49
Scarlet Ray Is New Traffic Signal . 49
"Seasick Chair" Tests Sailors . . 49
Magnifier in Pencil Style . . . 51
Turbine Locomotive Tested . . . 52
Telephone Meter Sells by Word . 56
Lifeboat Inflated Like Tire . . . 56
Self-Service Hat Checker . . . 57
Amazing Engine Tested 57
Tent Train Saves Pavement . . 58

Radio

Electric Device Makes Synthetic Music 12
Engineer and Brakeman Talk by Radio 12
Wave of Hand Starts Steel Mill . 12
Lights Controlled by Radio . . . 39
Turns Your Phone into a Radio Set 49
Big Gain in Radio Precision . . 51
Neat Wiring Made Easier . . . 64
Binding Posts That Hold . . . 64
Locating the B-Eliminator . . . 64
Shield the Detector Tube . . . 64
A B C's of Radio 64

Unusual Facts and Ideas

Baseball at Night under Floodlights 13
Giant Locomotive and Its "Pup" . 13
Huge Switchboard for Summer White House 13
World's Highest Dam 37
Your Capacity to Learn 38
Tiny Plants Tunnel in Stone . . 38
Can Animals Run Machines? . . 38
A Welding Shop on Wheels . . . 44
Thousands of Tons of Color . . 44
Personalities Made Over . . . 45
Bees Sip Poison 45
Largest Dock in the World . . . 46
Earthquake "Made to Order" . . 46
Expedition to "Lost World" . . 46
Hop Growers Work on Stilts . . 46
How Much Do You Know of the World You Live In? 46
Dike to Enlarge Holland 47
Bulkiest Freight Parcel 47
Aviator Chases Rainbow 47
Horse's Mummy in Coffin . . . 47
Biggest Family, 44 Children? . . 50
Seeds Forecast Tree Sizes . . . 50
Dropper Feeds Tiny Birds . . . 50
Garden Is Floral U. S. Map . . 50
Unpacking a 23-Foot Python . . 51
Huge Book Taller Than a Man . 51
Rat-Proof Ships End Plague . . 51
Start of Balloon Race 52
Fearless Men Vanishing from the Earth? 52
Almost Beats the Camera . . . 53
Prehistoric Monster Lives . . . 53
2,000,000-Year-Old Pine Cone . . 53
Schoolboys Build a House . . . 55
Live on a Vast Ice Cake 56
Pipe Sweetened by Steam . . . 56
Fights Skyscraper Fires 57
What Turns Animals White? . . 58
Mighty Natural Springs Could Supply Cities 58
Birds' Nest in Mop 58
Organ Nearly Wrecks Itself . . 58
Insane Sleep in Sawdust Bed . . 137
Zoo Sells Elephant Hides . . . 137
Roman "Cannon Ball" Found . . 143
Grasshopper in a Glacier . . . 143

For the Home Builder

Are You Planning to Buy an Oil Burner? 59
Sash Weights Force Stubborn Window 82
Shelves for a Child's Room 86
Invisible Springs Keep Windows from Rattling 86
Adding a Room to Your House . . . 94
How to Insert Flashing under Old Shingles. 104
Combination Awning and Shutter for Bungalow 110
Puttying Sash Lights 112

Hints for the Mechanic

Draft Regulator Protects Boiler . . 116
Milling Cutter Locates Index Plate Holes 116
Simple Shop-Made Chuck for Hole Grinding 117
Old Auto Motor Used for Hoist . . 117
Illuminated Table for Tracing Blueprints 118
Pencil Holder for Dividers 118
Angle Iron Rack Holds Many Tools 119
Indexing Welded Gear Teeth . . . 119
How to Obtain a Light Driving Fit Quickly 120
Clamp for Holding Small Round Finished Plates 120
Triple Center Punch Lays Out Dies . 121
Welding Torch Bushes Holes in Foundry Flasks 121
Piston Ring Keeps Line Shafting Clean. 121

Ideas for the Handy Man

Improvises Rudder Post from Car Parts 55
My Motorized Shop Cost $20 . . . 76
Unique Noah's Ark Toy Floats or Runs on Land 80
A Handmade Canoe Paddle 80
Simply Built Reading Tables . . . 81
What You Can Make of Stone. . . 82
How to Take Up Rod Bearings . . 84
Hints on Using Hand Screws for Woodwork 84
A Cube for You to Whittle 88
Toy Auto Built for Speed 90
A Cabinet for Your Curios 92
An Aquarium at Low Cost 96
How to Make Tables, Chairs and Accessories for the Camp 98
Simple Straw Instrument Measures Humidity 100
Net Handle Aids in Shooting a Bow . 101
How to Make a Sewing Cabinet with Lyre-Shaped Legs 102
A Dressing Table for Baby 104
"Framing" Pictures with Fiber Wallboard. 106
What Do You Want to Make? . . . 107
Making Garden Hose Washers . . . 110
Replacing a Broken Glass Knob . . 110
Iron Holder and Stand 111
Tightening Loose Casters 111
Linoleum Drainboards 112
New Ways to Paint 113
Combed Stencil Effects for the Ameteur Decorator. 113
Ammonia in the Home Workshop . 114
How to Prolong the Life of a Wooden Mitre Box 115
An Easy-to-Fit Cork. 115

More Than 250 Striking Articles in This Single Issue
Cover from Every Angle the Latest Developments
in the World of Invention and Discovery

WHAT IS NEW THIS MONTH

Table of Contents for October

LEADING ARTICLES

COMMANDER BYRD TELLS HOW TO GET INTO AVIATION 9
Famous flyer answers a young man's questions about the flying game

THE CONFLICT BETWEEN SCIENCE AND RELIGION 12
Introduction by Bruce Barton
A discussion of evolution and theology by leaders in public life

AIRMAN PLUNGES SEVEN MILES IN BLAZING PLANE 14
By L. G. Pope
The miraculous escape of an altitude flyer, seeking a record

ONE MILLIONTH OF AN INCH PHOTOGRAPHED! 15
New steel-making secrets from high-powered microscopes

WHAT LINDBERGH FOUND IN HIS MAIL BAG . . *By Fitzhugh Green* 18
Surprising facts about the greatest postal deluge in history

WHAT BABIES BORN TODAY MAY SEE . . *By Myron M. Stearns* 21
Scientists' prophetic vision of the future

LADYBUGS BRED TO SLAY PESTS . . . . . *By Arthur A. Stuart* 23
Queer soldiers in an amazing battle

TREASURES FROM THE SKY . . . . . *By Neil M. Clark* 27
Astonishing new facts about meteorites

MODERN MAGIC IN LIGHT . . . . . *By Robert E. Martin* 30
Marvelous creations of engineers who study illumination

THE MODERN "ICEMAN" ARRIVES . . *By Prof. Collins P. Bliss* 33
An authoritative discussion of iceless refrigerators

THEY'RE CREATING A NEW WORLD . . *By Louis E. Van Norman* 35
How chemistry's triumphs are remaking your daily life

CHART TELLS WHEN TO MARRY . . . . . *By Hornell Hart* 39
A fascinating scientific way to foretell your chance of happiness

NEXT—THE CRASH-PROOF PLANE 43
Inventors' ideas that may end danger in flight

SAM LOYD'S PUZZLE PAGE 66

IS YOUR HOUSE BURGLAR-PROOF? . . . . *By John R. McMahon* 67
Simple ways to guard your home against intruders

DON'T BE A BACK-SEAT DRIVER! . . . . . *By Martin Bunn* 69
Gus shows the dangers of too much advice by passengers

THE ANSWERS TO YOUR QUESTIONS ON RADIO OPERATION . . . 6

THE FINANCIAL ADVENTURES OF JERRY QUIRK . *By Wallace Ames* 4

FICTION

TAILS UP! . . . . . *By Cy Caldwell* 24
Tense moments of a test pilot, as told by one of them

WHIRLING WHEELS—PART THREE . . . *By Edmund M. Littell* 40
The Story of the Automobile Age in a fascinating novel

RADIO

RADIO QUESTIONS EVERYBODY ASKS 62
Common queries answered by an expert

TRENDS OF THE YEAR IN RADIO . . . . . *By John Carr* 63
A survey of what the market offers broadcast fans

MODERN "B" SUPPLY FOR OLD SETS . . . *By Alfred P. Lane* 78
How to adapt the "De Luxe" or factory-built eliminator

THE HOME WORKSHOP

PATCHING DAMAGED FURNITURE . . . . *By Chelsea Fraser* 75

A FLYING MODEL OF LINDBERGH'S PLANE 76
By J. Danner Bunch and Avison F. Koch

BETTER HEATING AT LOWER COST . . . *By Charles B. Carlon* 77

Automobiles

He Manufactures Half-Size Autos . 38
"Puncture-Proofing" Tested by Uncle Sam 53
Know Your Car 68
Auto Jack Always in Place 58
Engine Pumps Air Mattress . . . 70
Windshield Wiper Holder 70
Ten Dollars for an Idea 70
Emergency Valve Grinder 70
Chains Last Twice as Long 70
Simple Holder for Hats 70

Aviation

Chamberlin's Flight from the *Leviathan* 16
Huge British Transport Plane . . . 20
Ten-Passenger Monoplane "Safe as Motor Car" 20
Luxurious Air Service in Europe and Asia 20
Extra Wing Gives Stability 20
Smallest Monoplane? 20
Tiny English Flying Boat 20
Huge Beacons on Wheels for Air Defense 26
New Flying Battleship 29
Balloon Sets Distance Record . . . 52
Porous Parachute Safer 56
Balloon Can Fly for Weeks 56
What Speed Can Man Endure? . . 56
Beacons Pierce 15-Mile Fog 56
Midget 250-Pound Monoplane . . . 56
Radio Lights Guide Aviator . . . 56
A Plane with Revolving Wings . . 56
Glider Moves Wings Like a Bird . 57
Finnish Plane Has Ice Runners . . 57
Air Tour Cheaper Than Rail Fare . 57
Planes Used in 156 Ways 57
New American Air Lines 57
Reveals How Birds Fly 57
Sky Ambulance Travels on Plane . 57
"Flying Doughnut" Plane Crashes . 59

Exceptional People

Shoots Himself from a Cannon . . 16
Young Inventor Wins Big Reward . 17
Builds Luxurious Doll's Castle . . . 54
Woman Becomes Oil Expert 54
The Youngest Deep-Sea Diver . . . 54
Amateur Astronomer Builds Camera 54
Monk Carves Passion Play 55
Girl Druggist at Twenty-One . . . 55
Builds Huge Camera on Auto . . . 55
Sculptures with Dental Tools . . . 55
Airport Run by a Woman 55
Clergyman Builds Own Church . . 55
A Real "One-Man Band" 59

Health and Hygiene

Modern Pace Takes Its Toll 36
Poor Blood Causes Old Age 46
Hardy Germs Survive Boiling . . . 47

October, 1927, Vol. 111, No. 4. **Popular Science Monthly** is published monthly at 250 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Chicago, Illinois. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1927, by the Popular Science Publishing Co., Inc. Single copy, 25 cents. Yearly subscriptions to United States, its possessions, and Canada, $2.50; foreign countries, $3. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, **Popular Science Monthly** does not underwrite the business methods of the individuals or concerns producing them. The use of **Popular Science Monthly** articles for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

English Foot Census to Standardize Sizes 47
Nerves at Work Get "Het Up" . . 53

Laboratory Discoveries

Fastest Top in the World 36
Tests "Fire Thermometer" 36
Predicts Race of Supermen 37
Coat of Paint Warms House. . . . 44
New Tones from the Flute 45
Platinum Analyzes Breath 45
Atoms Smashed at Last, Scientists Declare 53

New Devices for the Home

Ingenious Rubber Cap for Bottles. . 60
Dishing Ladle Serves as Mold . . . 60
Triple Kettle Conserves Fuel . . . 60
String Beans Cut by Machine . . . 60
A Funnel for Small Bottles 60
New Lightweight Vacuum Cleaner . 60
A Combination Can Opener 60
Knives Made of Stainless Glass . . 61
A Food Grinder for Every Need . . 61
A Lock that Can't Be Picked . . . 61
Miniature Electric Range 61
Handy Grapefruit Corer 61
Adding a Handle to Sauce Bottle . 61
Simple Device Shells the Peas . . . 61
Gas Range Has Broiler Drawer . . 61
An Improved Cheese Knife 61

New Processes and Inventions

New Amphibious War Tank. . . . 16
Remarkable Car Fights Forest Fires 17
Air Propellers Guide Rudderless Boat 17
Electrical Machine Audits Sales . . 17
Designs Trans-Atlantic Speedboat . 17
Inventions Speed Up Modern Football 32
Dryer Makes Hay While It Rains! . 32
What the World Wants of Inventors 38
A Sight-Seeing Railroad Car. . . . 44
Steel Belt Mends Tools 44
Whirling Shafts Move Sugar. . . . 44
Silk Made from Cornstalks Promises Farmer Profits 45
"Centipede" Aids Tunneling . . . 45
Asphalt "Cures" Concrete 45
Electric Timer at Regatta. 46
Speedometer Used to Measure Crops 47
Tests a Pianist's Muscles 47
Grass Clippers Save Your Hands. . 48
A Hair-Curling Automat 48
Tool Removes Broken Screws . . . 48
Hay Cut and Stored by Compressed Air Machine. 48
Balloon Life-Preserver 48
Toasts Bread at Sixty Slices a Minute 48
Novel Hoist Piles Lumber in Mill Yard 48
Sensitive Device Detects Voice's Flaws 48
Children Pedal Own Merry-Go-Round 49
Odd Magnifying Glass Self-Focusing 49
Skinless Hot Dogs Perfected. . . . 49
Non-Spillable Drinking Cup for Travelers 49
Combination Fountain Pen and Knife. 49
"Headlights" for Pedestrians . . . 49
A Many-Purpose Microscope-Telescope 49
Shoots Himself to Test New Armor . 49
Hot Air Polishes Metal 50
Big Balloons from Tire Tubes . . . 50
"Electric Eye" Gives Burglar Alarm 51
A Garden on Shelves 51
"Rockingbed" Duplicates Train Jolts 54
He Swims by Machinery 58
A Distillery for Steel 58

Natural Wonders

Bottom of Sea Yields Oil 36
Looking into a Volcano 37
Braving Arctic for Science. 37
A Mystery of the Heavens 44
Study Your Rainbows; Data May Aid Science 46
Filming Earthquakes 47
Trailing Will-o'-the-Wisp 51
Hailstones Big as Baseballs Puncture Auto Tops 52
Raindrops' Measures Taken 53

Radio

Radio Hastens Barley Growth . . . 46
Helps Ships Defy Fog 47
Power on Short Wave 50
Radio Set in Cone Speaker 50
New Radio Time Signals Keep World in Step 52
Motor Run by Radio 54
A B C's of Radio 65
Advantages of Cabled Leads . . . 65
How to Use Condensers. 65

Unusual Facts and Ideas

The "Fighting Face" of a Battleship 16
Huge Bearings for Australian Bridge 17
Footprints Milleniums Old 36
Ants Practice Agriculture 36
Snakes' Hospital Has Beds and Diet of Imported Bugs 44
Giving Steam "Elbow Room" . . 45
"Pillows" Made of Milk 46
Gas Warfare Called Humane . . . 46
Everglades to Be Reclaimed . . . 46
Hands Shape Hammer Handle. . . 46
Smallest Book in the World 47
Vampires Let Victims Sleep 47
"White Terror" of Sea Ended . . 50
Snakes Outwitted 50
Does Earth Turn on Core? 51
Root Grows Like Duck's Head . . 52
Twenty-Five Acres of Glass 52
Shipyard Built Far from Sea . . . 52
Lamp Made of Gun Shell 53
Toy Soldier Many Ages Old . . . 53
Eagles Trained to Hunt. 53
All Bride's Attire Synthetic 53
High Pressure to Crush Egg . . . 58
Railway School Underground . . . 59
How Much Do You Know of the World You Live In? 59

For the Home Owner

Paper Hanging Made Easy 80
Clothes Hamper of Woven Paper . 100
Novelty Finishes for Woodwork . . 100
Removing Paint from Woodwork . 112
Staining New Wood to Match Old . 112
Refinishing Golden Oak Chest . . . 114
Gray Stain Effect on Oak 116
How to Sandpaper Moldings . . . 118
Removing Furniture Blemishes . . 118
How to Free Nickel from Rust . . 118
How to Prevent Brown Spots in Painting Cedar 137
Imitation Antique Oak 145
How Much Wall Paper to Order . . 144

Hints for Mechanics

When's a Right Angle Right? . . . 82
Repairing a Split Saw Handle . . . 92
Dressing a Worn Emery Wheel . . 98
Why Some Saws Have "Nibs" . . . 106
Center Punch for Young Machinists to Make 122
Gages for Milling Cutters 122
Old Bill Says— 126
Grinding Threads on a Lathe . . . 127
Square Ladle for Pouring Metal . . 128
Old Tap and Valve Handle Used as Chuck Wrench 128
Heavy Trammel Points for Large Layouts 129
How to Protect Reamers 129
Testing Dies for Hardness 131
Self-Centering Punch for Use with Templates 132
Special Lathe Dog 133
Speedy Tool for Boring Large Holes in Wood 134
Special Tools for Auto Repairs . . 141
Replacing Electric Motor Bushings 146
Old Wrench Serves as Anvil . . . 146

Ideas for the Handy Man

Finishing Your Ship Model 84
How to Build a Boudoir Cabinet . 86
Barbless Arrowheads for Hunting . 94
A Simple Outdoor "Gym" 96
Wear-Proof Thwart Fastening . . . 96
Lattice Decorates Flower Box . . . 98
Clamp for Gluing Furniture 98
Bench Plate for Riveting 98
Blueprints for Your Workshop . . 102
Tape Aids in Taking Portraits . . 104
An Automatic Camera Timer . . . 104
Miniature Clocks Easy to Build . . 106
Toy Whistle Made from Spool . . 108
How to Lengthen a Stepladder . . 108
Home Workshop Chemistry 110
Bed Rail Joints for Tables 120
Building a Circular Tower 120
Novel Test for Electric Cord . . . 120
Bench Legs from Angle Irons . . . 126
How to Make Anchor Bolts 127
Ship Models from Our Blueprints . 130
Bit of Thread Detects Gas Leak . . 134
Uses for Old Umbrellas 137
Novel Way to Decorate China . . 138
Sewing Cabinet of Rare Charm . . 142
Installing Ship Model Lights . . . 157

Hundreds of Striking Articles in This Single Issue
Cover from Every Angle the Latest Developments
in the World of Invention and Discovery

WHAT IS NEW THIS MONTH

Table of Contents for November

LEADING ARTICLES

I'm Going to Raise My Boy to Be a Plumber 9
By Kenneth Wilcox Payne
Does a college education pay?

Is Flying Really Safe? . . . . . *By George Lee Dowd, Jr.* 12
The truth about the dangers of aviation

Fix Limits of the Universe . . . . . *By Edgar C. Wheeler* 15
Astronomy's new measurements of the world

An Unrockable Ship 17
Keeping a yacht steady with a mighty gyroscope

Who Did the Shooting? . . . . . *By Calvin H. Goddard* 21
How a bullet's "fingerprints" yield telltale clues

Laboratory May Produce Life . . . *By Sir Oliver Lodge* 23
A startling prediction by a noted scientist

A Third Degree for Automobiles . . . *By Fay Leone Faurote* 24
Cars tested in amazing new ways

You've Got a Patent, But— . . . . . *By Bruce Donald* 26
Mistakes some inventors make in safeguarding their ideas

Can the Bees Talk? . . . . . *By Myron M. Stearns* 27
Marvels of communication that rival our own

New Methods of Traffic Control . . *By Earl Chapin May* 29
How American cities are fighting congestion

Geniuses Who Created Planes of Air Heroes *By H. A. Bruno* 32
High spots in the lives of famous aviation designers

An Oil Subway of 90,000 Miles . . . *By Robert E. Martin* 34
The thrills and romantic history of pipe-line laying

Mirages—Nature's Own Fakes Exposed . . *By H. C. North* 37
New discoveries about famous illusions

Bridges Built of Magic Dust . . . . . *By Earle Duffy* 39
Wonders of the Concrete Age we live in

Every Roof a Landing Field 45
An inventor's novel scheme to launch and land planes

Your Aviation Questions— 60
Answers to perplexing queries about flying

Sam Loyd's Puzzle Page 66

Whole Rooms That Fold Up . . . . *By John R. McMahon* 67
Disappearing beds and stairways for your home

Driving—Dozing—Death! . . . . . *By Martin Bunn* 69
Gus and Joe warn the sleepy motorist

Keep in Mind These Points If You Use Electric Supply for Your Radio 6

How Roger Bates Invested His Money . . *By Wallace Ames* 4

FICTION

Contact! . . . . . *By Armstrong Perry* 18
How a Signal Corps man saved a regiment

Whirling Wheels—Part Four . . . *By Edmund M. Littell* 42
Romance and automobile history in a stirring novel

RADIO

All About Single Dial Control . . . . . *By John Carr* 62
A Simple Power Amplifier . . . . . *By Alfred P. Lane* 76

THE HOME WORKSHOP

How to Do Decorative Metal Work . . *By Edward Thatcher* 73
A Radio Cabinet You Can Build. . . . *By Charles A. King* 74
Easy Ways to Handle Heavy Work. . . *By H. L. Wheeler* 78

Astronomy

If the Sun Should Blow Up We'd Live Only 138 Hours 53
Biggest Telescope Too Big 56
Sun Just Starting 57

Automobiles

Making the Grade 31
Windmill Rainbow Car Light . . . 46
"Gasoline" Made from Coal . . . 48
Solid Tires May Blow Out 48
Dangling Straps Warn Motorists of Trains 49
A 30-Inch Car 51
Express Lanes for Motoring 52
Know Your Car 52
Autos Play Leapfrog 59
Piston Groove Cleaner 70
Dash Indicator for Lights 70
Ingenious Auto Striper 70
Extra Curtain Adds Comfort . . . 70
Curbing Unruly Tractors 70
Ten Dollars for an Idea! 70
Solving Auto Engine Secrets. . . . 144
What to Look for When Your Car Overheats 130

Aviation

Risks Death in Homemade Blimp . 54
First Air Truck Delivers Typewriters by Parachute 54
Airplane Factories Swamped with Orders 54
Students in Flying Record 54
New Air Endurance Mark Set . . . 54
Air Explosion Peril Reduced. . . . 54
Red Lights to Warn Flyers 54
Flyer Safe in Four-Mile Fall. . . . 54
Navy Catapult Secrets Guarded . . 55
Air Express Cuts Mail Rates . . . 55
Two Planes Talk by Radio in Flight 55
Volume of Air Mail Leaps. 55
Airplane of 2,000 Years Ago . . . 55
U. S. Takes All Helium Output . . 55
Upside Down Flying Record . . . 55
Newest Ocean Landing Field . . . 55
New Motorized Balloon. 55

Exceptional People

He's Uncle Sam's "Official Watch". 41
Priest Makes Safety Devices. . . . 53
Kidnapped by 500-Pound Fish. . . 56
Turntable Cyclist 58
Official Candy Eater 59

Explorations

America Found 1000 B.C.? 41
Metal Mirrors of Flappers in Ancient Greece Unearthed 47
Crusoe's Island an Eden 52
Tenting on an Iceberg 53

Health and Hygiene

Mind Works Best When Tired. . . 36
Oxygen Shortage Causes Stammering 40
Gains in Medicine 40

November, 1927, Vol. 111, No. 5. **Popular Science Monthly** is published monthly at 250 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Chicago, Illinois. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1927, by the Popular Science Publishing Co., Inc. Single copy, 25 cents. Yearly subscriptions to United States, its possessions, and Canada, $2.50; foreign countries, $3. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, **Popular Science Monthly** does not underwrite the business methods of the individuals or concerns producing them. The use of **Popular Science Monthly** articles for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

Doctors Vindicate Hair Bob . . . 46
Sleeping Sickness Kills 5000 46
Electric Baths for Noses 47
Seasickness Laid to Plain Fear . . 48
Surgical Chisel Driven by Air . . . 48

Laboratory Discoveries

Testing Food by Color 41
May Solve Mystery of Magnet-Bent Light Rays 41
Seedless Grape Defies Winter . . . 46
Microbes Produce Copper 48
Man Evolved from Dust, Not Apes, Chemists Find 48
Hope Dashed for Gold in Sea . . . 49
Time Clock Held on Sound 49
New Television Idea 58

Models

Ship Made with Two Tools 48
How to Hold Ship Model Hulls for Shaping 118
Troubles with Overheated Cars . . 130

New Devices for the Home

Anti-Rattle Spindle Keeps Your Doorknob On 64
New Machine Extracts All the Fruit Juice 64
Peels Oranges and Potatoes by Turning a Crank 64
Novel Bread Knife Has Odd-Shaped Edge 64
Specially-Designed Kitchen Cabinet Fits Beneath Your Range 64
Tea Strainer of Unusual Design Has Pouring Spout 64
This Spiralled Disk Keeps Your Milk from Burning 64
Non-Tarnishable Eggs Spoons Save Your Silver 64
Folding Window "Inserts" Make Washing Easy 65
Message for Milkman in New Bottle Top 65
Plunger on New Fork Drops Its Contents at Will 65
Strainer That Fits Over Tea Cup Retains Grounds 65
New Needle Magazine Picks One Out for You 65
A Toothbrush Adjustable to Any Position 65
Improved Clothes Reel with Ratchet Tightener 65
Spoon and Fork Combined in Unusual Cooking Utensil 65

New Processes and Inventions

New Rock Borer 14
Light Rivals Sun 14
Aluminum Plates Speed Map-Making 40
Television Opera 40
Electric Plow Kills All Pests 41
New Use for Vacuum Tubes 41
Fireman Dives in Gas Mask 46
A Realistic Mechanical Football Contest 47
Lawn Mower of Razor Blades . . . 47
"Mechanical Ears" Beat Man's . . 47
A Mail Box for Motorists 48
Full Novels on Phonograph Produced by New Process 43
Wire Stretcher Saves Fence 48
Rest for Overworked Tongue . . . 49
Ocean Undercurrents Filmed . . . 49
"Foot Fins" Help Swimmer 49
A Home Hair Clipper 50
Babies Rocked by Electricity . . . 50
Blast Precools Fruit Cars 50
Gun Shoots Light Rays 50
New Golfing Machine 50
Tape in Pencil 50
New Bicycle Boat 50
Shocking by Foot 51
Side-Vision Glasses 51
Keyless Saxophone 51
A Folding Boat 51
Motor Paints Road 51
Gas Is Made from Sawdust 51
Horse-Racing Odds Figured by Mechanical Bookmaker 52
New Gliding Effect on Piano . . . 53
"Mechanical Man" Gets Angry . . 56
"Plane" for Baby Aviators 56
Gasoline Engine for Freight 56
Electric Landslide Alarms 56
Removing the Dust from Industry . 57
Chair Folds into Package 57
A Paint Gun on a Pole 57
A Sea Thermometer 58
Super-Locomotive 58
Life-Saving Rocket 59
Germans Make Gas from Sewage . . 154

Photography

Movies Made More Natural 47
70,000 Homemade Movies 57

Radio

A Not Quite So Loud Speaker . . . 47
How to Shield Your Receiver . . . 61
Queer Sources of Hum 61
Useful Resistance 61
A B C's of Radio 61

Unusual Facts and Ideas

Vesuvius Busy Again 14
Phonograph's Birthday 14
Measuring to Shanghai 14
Leaning Tower's Peril 14
Flood a Blessing 14
Parachute Tows the Baby 31
Joys of a Bull-Fighter 31
Treadmill Trains Dogs to Run . . . 31
A One-Man Power Plant 31
Air Liner Becomes Playhouse . . . 31
Sixty-Foot Tower Built of Concrete Staves 36
Windmills Give Electric Power . . . 40
Steel for Paving 40
Ants as Nurses 40
"Blood Tells" in Animals, Too . . 41
Building Spires Doomed 41
Dictaphone in Harbor Records Soundings 46
Just a Rainy Day Railroad 46
Fighting Gorilla, Doctor Finds Him Left-Handed 46
Nation's Gas from One Plant . . . 47
Second Highest Dam Planned . . . 48
Ship Made with Two Tools 48
Flameless Fire of Rust Causes Losses of Billions 49
2,000,000 Lepers in the World . . . 49
Some Power! 52
Home Heated by Sawdust 52
How Much Do You Know of the World You Live In? 53
The Mechanical Stevedore 53
One Wheel Rules Power of 80,000 Horses 56
Suffocating Goldfish Saved 56
Cats and Dogs Color Blind 57
Milk Sold by the Chunk 57
Snake Myths Spiked 57
No Peril of World Starving 57
A Pontoon Crane 58
Operating on a Dragon 58
Ship Flirts with Iceberg 59
Largest Mobile Gun 59

For the Home Owner

How to Beautify Your Fireplace . . 81
Better Heating at Lower Cost . . . 84
Paper Hanging Made Easy 89
Ventilating Hood Carries Off Cooking Fumes 125
Basement Storage Racks 125
Window Ventilators 126
Marking Your Screens 126

Hints for the Mechanic

System in Surface Grinding 112
Easily Made Reel Holders Keep Wire Handy 113
Reaching Difficult Oil Holes 114
How to Care for Drills 114
Taking a Heavy Cut 114
Blue Color Gages Machining Speed . 114
Finishing a Cast-Iron Part 114
Grinding Hints 114
Left-Handed Filing Safest 114
Holder for Countersunk Screws . . 114
Hunting Trouble in Shop Motors . . 115
Convenient Holder for Valves to Be Filed 116
Box for Heating Small Parts with a Torch 117
Depth Can for Hardening Ends of Long Rods 117
Making Center Reamers in the School Shop 124

Ideas for the Handy Man

Five Ways to Paint Tilt-Top Tables . 75
Enter the Stage Carpenter 80
Boring Guide Makes Furniture Building Easy 82
Using Wood Screws 86
How to Repair and Polish Furniture 92
What You Can Do with Oxalic Acid 100
Blueprints for Your Home Workshop 102
Quick Ways to Mix Paste and Trim Wall Paper 104
Small Bending Dies for Sheet Metal Parts 106
Hints on Paper Hanging 106
A Roller Rack for Ties 108
What You Can Make with Wallboard 110
Handy Test Tube Rack for the Home Laboratory 118
How to Finish Curtain Poles in Polychrome Effects 128
"Comicull" Doll Has Clothespin Body 132

Hundreds of Striking Articles in This Single Issue
Cover from Every Angle the Latest Developments
in the World of Invention and Discovery

WHAT IS NEW THIS MONTH

Table of Contents for December

LEADING ARTICLES

RUBBER FROM WEEDS MY NEW GOAL—Edison 9
By Frank Parker Stockbridge
The great inventor's story of his latest research

AIR-RAIL LINES MAY SPAN U. S. . *By William P. MacCracken, Jr.* 12
Transportation of the future as seen by a high Government official

MYTHS ABOUT MARS EXPLODED . . . . *By Donald H. Menzel* 15
A noted astronomer's new description of the red planet

FIGHTING BAD BUGS WITH GOOD . . *By John Walker Harrington* 20
Amazing ways insects save crops

MARCONI—THE FATHER OF RADIO . . . *By Alden P. Armagnac* 22
How transocean wireless "happened"

THE HUMAN MIND CRAVES WONDERS . *By Morris Fishbein, M.D.* 23
A medical authority's explanation of the quack's appeal

FIFTY YEARS TO BUILD CHURCH . . . . . *By Jesse F. Gelders* 25
Why the newest cathedral will stand for twenty centuries

GETTING READY FOR THE NEXT WAR . *By George Lee Dowd, Jr.* 26
New engines of destruction for tomorrow's combats

WALK EAST AND YOU LOSE WEIGHT. . . *By Thomas M. Johnson* 28
Startling facts of "relativity" explained

SIR ARTHUR KEITH SAYS DARWIN WAS RIGHT *By Edgar C. Wheeler* 29
An expert's summary of the evidence for evolution

CLOTHES WOVEN FROM ROCK. . . . . *By Orville H. Kneen* 31
Marvels of asbestos, the wonder mineral

WELDER—NEW TAILOR OF STEEL . . . . . *By L. G. Pope* 32
Forging industry's structures with white-hot metal

"I'M GOING TO SEND MY BOY TO COLLEGE" . *By J. B. Minnerly* 34
An answer to the claim that "higher education" doesn't pay

HUNTING WILD ZEBRAS WITH FISHPOLES . *By Thomas W. Phelps* 37
How African zoo collectors succeeded when cowboys failed

AVIATION NEEDS 10,000 YOUNG MEN . . . *By Caleb Johnson* 43
Why many besides pilots are wanted in the flying game

HOW THE HIGH FLYERS CLIMB 45
Strange equipment for man and motor in altitude planes

SAM LOYD'S PUZZLE PAGE. 66

BUILD FOR YOUR WIFE, BUT— . . . . *By John R. McMahon* 67
Hints on avoiding costly alterations in your plans

"YOUR CAR NEED NEVER FREEZE" . . . . . *By Martin Bunn* 69
Gus and Joe discuss a pressing winter problem

NEW RADIO PRODUCTS APPROVED BY POPULAR SCIENCE 6
Institute of Standards

FINANCIAL ARTICLE. . . . . *By Wallace Ames* 4

FICTION

KAKA AND KAKAPO. . . . . *By Andrew A. Caffrey* 17
Dizzy misadventures of the air

WHIRLING WHEELS—PART FIVE . . . . *By Edmund M. Littell* 40
A thrilling automobile romance in novel form

RADIO

WHY CAN'T I OBTAIN TONE QUALITY? . . . . *By Alfred P. Lane* 62

THE HOME WORKSHOP

AT LAST—THE TRUE SANTA MARIA . . *By E. Armitage McCann* 73

NEW WAYS TO DECORATE GIFTS . . . . . *By Berton Elliot* 74

MAKING THE MOST OF THE VEE . . . . . *By Henry Simon* 78

Astronomy

Boy Builds Own Telescope . . . 46
Earth's Speed May Vary . . . 48
Telescope of Plate Glass 59

Automobiles

Motor Car Advance 38
Safety in Hub Light 47
Know Your Motor Car 47
Autos Built at Home of Junk, Resource, and Ingenuity 48
Three-in-One Motor Trunk . . . 50
Aluminum-Wheeled Car Built in Spare Time 59
Water Pumps Tires 70
Fighting Snow on Windshields . . 70
Cures Sagging Garage Doors . . 70
Novel Secret Switch 70
Weatherstripping Your Garage . . 70
Ten Dollars for an Idea! 70

Aviation

Airplane Rains Men 14
U. S. Deliberately Burns an Airplane 14
Half Plane, Half Dirigible . . . 47
Frame of Giant Air Liner . . . 48
Plane Crash Harmless Here . . . 48
New Air Mapping Invention . . 49
Alarm Clock for Dozing Aeronauts . 50
Skeleton Plane for Novices . . . 52
Chicago-Mexico Air Mail . . . 54
Macready May Win Record . . 54
A Bomber's Balloon Tires . . . 55
"Vest Pocket" Balloon Trip . . 55
Nearly 5,000 Aviation Pupils . . 56
Airdrome Afloat Nears Completion. 56
Monoplane's Unstrutted Wings Hold 17 Men 56
Good Airplanes Built in Many Good Designs 57
Amphibian Commuting Planes . . 57
Propeller Serves As Airplane Brake . 59
Seaplane Kings 59

Exceptional People

Champion Woman Nail Driver . . 52
Sprinter's Sprinting Family . . . 53
He Goes Fishing with a Kite . . 55
The Greatest Woman Cabinetmaker 59

Explorations

Volcanoe Island Alters Its Face . . 38
Three Boats Battered to Bits Filming the Colorado Rapids . . . 55
Bicycle Glacier Climbing . . . 59

Health and Hygiene

Deaf Mute "Listens In" 38
Antitoxin Victor Over Erysipelas . 38
Tides of Blood Present Problem . 39
Ultra-Violet Window Panes . . . 46
Year Breaks Health Record . . . 55

December, 1927, Vol. 111, No. 6. **Popular Science Monthly** is published monthly at 250 Fourth Avenue, New York, N.Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Chicago, Illinois. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1927, by the Popular Science Publishing Co., Inc. Single copy, 25 cents. Yearly subscriptions to United States, its possessions, and Canada, $2.50; foreign countries, $3. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, **Popular Science Monthly** does not underwrite the business methods of the individuals or concerns producing them. The use of **Popular Science Monthly** articles for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

Laboratory Discoveries

Measuring to Billionth of Inch . . 14
Engines Run on Fish Oil . . . 38
Tiniest Particle May Be Etheron . 39
Rain Making Yet Unachieved . . 39
Earthquakes to Order Next? . . 39
Testing New Cable Insulation . . 39
Mystery in Electric Vapor . . . 46
Wave Lengths of Elements . . . 48
Traffic Paint Endurance Test . . 49
A Window-Envelope Contest . . 49
Copper Hardened for Knives . . 52
Crickets Chirp Temperature . . 52
Ready to Breed Supermen, Says Noted Gland Expert 53
X-Rays Speed Evolution 53
X-Ray Catalogues Minerals . . . 54
Aurora, 600 Miles in Air, Highest Ever Seen by Man 55
Measuring between Atoms . . . 55
Mystery of the Blue Geese Solved by Science 57

Models

Smallest Colliery 58
Ships Molded from Paper . . . 58
Paper Models Help Design Amateur Stage Settings 90
Building Airplane Models . . . 123

New Devices for the Home

Handy Scissors Sharpener . . . 64
A Breakfast Table Paper Rack . . 64
Pie Crust Mixer Is Woman's Invention 64
Sink Strainer Has Ingenious Folding Cover 64
Floor Lamp Tilts for Reading . . 64
A Window Lock You Can't Force . 64
Holder for Darning Cotton . . . 64
Renovates Your Furs 64
This Soap Holder Floats 65
New Can Opener 65
You Can Sit Up in This Folding Bed 65
Adjustable Rack for Pots and Pans 65
Fits the Candle to the Stick . . . 65
Double-Bottom Cooker Easy to Clean 65
Antiburglar Lock Attachment . . 65
Novel Bracelet Holds Yarn . . . 65

New Processes and Inventions

This Lighthouse Tends Itself with Electrical Machinery 46
Wrist Watch Winds Itself 46
Steam Clears Rails of Ice 46
Thermos "Food Trolley" Carries Hospital Meals 47
Electric Eye Runs Factory . . . 47
A Boat That Can't Capsize . . . 49
How to Tame Balky Wires 50
Ratchet Gives Bicycle High Speed . 50
Lightning Shorthand Typewriter . 50
Glass Violin String Case 50
Machine Tests Paint Brushes . . 51
Dustless Street Cleaning at Last . 51
New Economical Label Licker . . 51
A Mirror That Tells Your Height . 51
Machine Skins Wire in Hurry . . 51
"One Way Windows" Invented . . 53
Nickel-in-Slot Soda Water Dispensed in Ten Flavors 54
Fertilizer Made of Cocoa 54
Gas Made from Water by New Electric Cell 56
Rubber from Cactus Juice . . . 58

Photography

Camera Records Fly's Footprints . 38
Speeding Bullets Can Be Filmed . 46
Color Photography Nearer . . . 47
A Screen for Home Movies . . . 135

Radio

New Radio Photos 14
Trees Cast "Radio Shadows" . . 49
Plow Lays Radio Wire in Furrow . 50
Cooling Huge Radio Transmitting Tubes 56
Battle Tanks Talk by Radio . . . 57
How to Build Your Own Electric Radio Receiver 61
What Limits Your Distance? . . 61
Emergency Battery Measures . . 61
Balancing Condensers 61
New Socket for A. C. Tubes . . 61

Unusual Facts and Ideas

Ruined City of Tokio Rebuilt . . 14
New Aluminum Rival 38
Limits Seen for Television . . . 39
Test Poison Gas Masks 39
U. S. First in "Calamities" . . . 46
How Much Do You Know of the World You Live in? 46
Mica the Versatile Mineral . . . 47
Sharks Die in "Sea Desert" . . . 47
Trees Fight for Lives 47
A Bridge That Alters Shape . . . 48
Noisy Oysters Spoil Survey . . . 48
Bicyclist Has Trailer to Carry Children 49
"Hot Dogs" Capture England . . 49
Rubber Horseshoes 49
Native Foods Best 49
"Halfway to Heaven" on Fire Ladder 51
Snail Is a Rip Van Winkle, Sleeping for Twenty Years 52
Lion "Packs" Hardest Punch . . 52
Lunch Wagon Trails Patrons . . 52
Industry Shifts Westward . . . 52
Two-Mile Bridge Projected . . . 52
A Theater Curtain of Water . . 53
World's Smallest Scissors . . . 53
Building a Hippopotamus . . . 53
A Church on a Chassis 53
Gigantic Water Lilies 54
Tiniest Iceless Refrigerator . . . 54
Queer Rivers That Fail in Attempts to Reach Sea 54
Oil Tanks Made into Houses . . 54
Broadway Glare's 49 Rivals . . . 55
How Not to Clean Dress . . . 55
What Do You Want to Know? . . 55
Earth Tides Likened to Sea's . . 56
"Vacuum Bottle" Buildings . . 56
When Sea Gets Out of Gear . . . 56
Bridging the Hudson at Last . . 57
Race Horses with Glasses Run Faster, Tests Reveal 57
Flies Go Six Miles a Day . . . 57
Plant Punctures Tires 57
Census of Lightning Flashes . . . 57
A Housetop Farm 58
Chrysanthemums a Foot in Width . 58

For the Home Owner

Concrete Houses While You Wait . 60
Why Hot Water Pipes Freeze First . 60
Filter for Purifying Cistern Water . 111
A Workmanlike Way to Apply Wall-Board 113
Storing Screens in a Garage . . . 113
A Back Yard Incinerator . . . 121
Making Locks for Window Sashes . 121
A Prop for Your Clothesline . . 122
Patching Metal Roofs 122
Remedy for Sagging Doors . . . 128

Hints for the Mechanic

Quick-Acting Holder for Short Welding Rods 114
Clip for Vise Expedites Filing of Thin Work 114
Clamp Puller for Shafts 114
Making French Curves for Drafting Use 115
Hooklike Tool for Repairing Hydrants Quickly 115
Sockets Placed in Concrete Floor to Save Drilling 115
Lathe Used in Emergency to Cut Long Keyway 116
Grinding Taper Shanks on Arbors . 116

Ideas for the Handy Man

A Christmas Doll's House . . . 75
New Ways to Light Your Tree . . 76
Metal Work for Beginners . . . 80
How I Built a Desk from Scraps . 81
A Simply Made Push Sled for Baby 84
Restoring Antique Furniture . . 86
Hints on Laying Out a Home Workshop Compactly 88
A Joint You Can Take Apart . . 94
Kaleidoscope Made at Trifling Cost 95
How to Stripe Furniture . . . 95
How to Make a Tool Case . . . 96
Pencil Holder Improves Marking Gage 99
Oil in the Home Workshop . . . 100
Blueprints for Your Home Workshop 102
How to Drive Your Tool Grinder by Foot Power 112
Emergency Repair for Hacksaw Blade 121
How to Fasten Light Fixtures to a Cement Wall or Floor 127
Wood Filler Gives Two-Tone Effect 128
Ball Bearings Used as Wheels for Scooter 135
How to Rig Up a Simple Telegraph Line 136
Cutting Odd Shapes in Glass . . 136

Hundreds of Striking Articles in This Single Issue Cover from Every Angle the Latest Developments in the World of Invention and Discovery

OF THE HOUR—YET 25-YEARS PROVED

With a quarter-century of quality experience behind it, besides being the smartest automobile of the hour, the La Salle is Cadillac in its finest essence. Of slightly lesser wheel base than Cadillac, the La Salle is powered by the 90-degree, V-type, eight-cylinder engine for which Cadillac has long been famous.

FOR A SMALL DOWN PAYMENT—with the appraisal value of your used car acceptable as cash—you may possess a La Salle on the liberal term payment plan of the General Motors Acceptance Corporation—the famous G. M. A. C. plan

From $2495 to $2685, f. o. b. Detroit

LA SALLE

CADILLAC MOTOR CAR COMPANY

DETROIT, MICHIGAN , OSHAWA, CANADA

Division of General Motors Corporation

MANUFACTURED • COMPLETELY • BY • THE • CADILLAC • MOTOR • CAR • COMPANY • WITHIN • ITS • OWN • PLANTS

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

WHAT IS NEW THIS MONTH

Table of Contents for July

LEADING ARTICLES

WIRELESS POWER—THE NEXT GREAT INVENTION 9
By Alden P. Armagnac
Will radio and earth currents soon run the world's engines?

HOW FLOODS CHALLENGE SCIENCE . . . . *By Edgar C. Wheeler* 18
What science has learned from a great disaster

THE LARGEST PACKAGE EVER SHIPPED 20
The story of a remarkable engineering feat

CANNED FOOD AND YOUR HEALTH . . . *By Thomas M. Johnson* 21
An informative article on the diet question

STOCK CARS TESTED IN REAL RACES . . *By Joseph S. Edgerton* 23
How speed trials point the way to better automobiles

A NEW ERA OF HUGE BRIDGES . . . . . *By Orville H. Kneen* 24
A famous engineer tells why men now can build mile-long spans

COURIERS THAT NEVER FAIL . . . . . *By Jack O'Donnell* 26
Why the tireless homing pigeon is man's valued friend

WHAT GAME DO YOU PLAY? . . . . . *By Arthur Grahame* 27
A discussion of the "danger age" in sports

BRONCHO-BUSTERS OF THE AIR . . . . . *By Cy Caldwell* 29
What happens when a test pilot tries out a new plane

GLENN CURTISS SEES A VISION OF AVIATION'S FUTURE 32
Reported by Frank Parker Stockbridge
Startling predictions by a pioneer birdman

UNCLE SAM'S TOY COAL MINE . . . . . *By M. E. Clements* 36
Where Government scientists test mining hazards

HIS STRANGE WORLD CAME TRUE . . . . *By Don Knowlton* 37
How modern wonders vindicate Jules Verne's amazing prophecies

SAM LOYD'S PUZZLE PAGE 65

IS YOUR HOUSE TOO HOT OR COLD? . . *By John R. McMahon* 66
New discoveries about the uses of insulation

STOP THE NOISES IN YOUR CAR . . . . . *By Martin Bunn* 69
Gus and Joe tell how to trace rattles and squeaks

THE ADVANTAGE OF GROUP MANAGEMENT TO THE PUBLIC UTILITY INVESTOR . . . . . *By Wallace Ames* 4

WHAT IS A GOOD LATHE? . . . . . *By Carlos de Zafra* 6

FICTION

CHIEF OF BATTALION . . . . . *By Karl W. Detzer* 14
The thrills and science of fire-fighting portrayed in a graphic story

BARE HANDS—PART 5 . . . . . *By Hawthorne Daniel* 40
A gripping novel of man's conquest of Nature

RADIO

PERFECT "A" CURRENT FOR YOUR RADIO . . *By Alfred P. Lane* 61

YOU NEED A LIGHTNING ARRESTER . . *As told to Newton Burke* 63

THE HOME WORKSHOP

HOW TO APPLY ART TRANSFERS . . . . . *By Berton Elliot* 73

BUILDING A CORNER CLOSET . . . . . *By Everett Eames* 74

HINTS ON USING TAPS AND DIES . . . . *By F. S. Browning* 78

Automobiles

A Highway on the Roof Tops . . 43
Tests Autoist's Footwork . . . 44
Ignition Hints for Your Car . . . 44
New Auto Motor 46
"Taxis" Old and New in the Sahara 48
Theater Teaches Traffic Laws . . 49
Odd Cycle-Auto Solves Gas Problem 51
Rollers for Grade Crossings . . . 53
Measure Auto Seat's Bumps . . 55
Novel Siphon Starter 68
Screen Your Car 68
Switch to Control Generator . . 68
Pedal Extension Easy to Build . . 68
A Table for the Auto Lunch . . 68
Rope Luggage Carrier 68

Aviation

Fly Own Gliders in Novel Club . . 13
Trans-Ocean Airmen Crash in Test Flight 13
A Triple-Purpose War Plane . . 45
French Build "Ghost" Plane . . 47
Our First Ocean Air Liner? . . . 52
Germans Have Flying Yacht . . 53

Exceptional People

He's America's Orchid King! . . 39
She Makes Bike Tires 46
Makes Table of 51,000 Parts . . 46
He "Clocks" the Big Races . . . 47
Lumberman Models Forest Creatures in Wood 47
To Cross Ocean in Sailboat . . . 47
Loops the Loop in Auto 49
Commands Arctic Ship 54
Uses Homemade Diving Helmet . 55
He Makes Intricate Glass Apparatus 55
Girl Daredevil Rivals Men . . . 56

Health and Hygiene

What Your Nervous System Looks Like 34
Does a Permanent Wave Harm Your Hair? 34
How Do You Sleep? 35
Soap as a Germ-Killer 48
Deaths from Heart Disease . . . 49
Healing with Music 51
Salt "Peps Up" Miners 52
Don't Listen with Your Eyes . . 52
New Diabetes Remedy Replaces Insulin 53

July, 1927, Vol. 111, No. 1. **Popular Science Monthly** is published monthly at 250 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Chicago, Illinois. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1927, by the Popular Science Publishing Co., Inc. Single copy, 25 cents. Yearly subscriptions to United States, its possessions, and Canada, $2.50; foreign countries, $3. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, **Popular Science Monthly** does not underwrite the business methods of the individuals or concerns producing them. The use of **Popular Science Monthly** articles for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

In This Single Issue We Publish More Than 250 Articles Depicting the Latest Achievements and Discoveries in the World of Science and Invention

Students Take Poison in Test . . 54
How Does Noise Affect a Typist? . 54
Blood 1/20 of a Man's Weight . . 57

Laboratory Discoveries

A New Electric Insulator . . . 34
Earth's Bulgings Studied . . . 34
Ethylene as a Fruit Ripener . . 34
Cathode Rays Dry Paint Oils . . 35
Engineers Study "Cold Light" . . 35
Whitewashes Defy Heat 45
Test Machines in "Padded Cell" . 49
Science Explains "Bloody Rains" . 49

New Processes and Inventions

It Sees through Darkness and Fog. 12
New Microscope Lamp 35
Pullmans Substitute Bedrooms for Berths 39
Electric Hole Saw 44
It Measures Furnace Heat . . . 44
Shows When Gas Is Poor . . . 44
Ingenious Combination Tool . . 45
Three Lanterns in One! 45
Blocks Improve Acoustics . . . 46
Paper from Old Dollar Bills . . 46
Cutting Steel with Iron 47
Novel Device Compares Fingerprints 50
New Ultra-Violet Lamp Detects False Gems 50
Colored Lights Teach Piano . . . 50
Life Preserver Instantly Inflated . 51
New Fire Engine Uses Soap Suds . 51
Machine Tests Boxer's Punch . . 52
Tobacco Chemically Made . . . 52
"Eraser Key" Aids Typists . . . 53
Vise Holds at Any Angle 53
Odd Apparatus Produces "New Music" 54

New Devices for the Home

A Furnace That Feeds Itself . . 46
Are You Planning to Buy an Oil Burner? 56
New Fork Has Automatic Ejector . 58
Oversize "Tea Ball" Cooks Rice . 58
Cup-Size Egg Beater 58
Wide-Rim Pie Plate Can't Spill Juice 58
Candy Making Instrument Set . . 58
Versatile Traveling Iron 58
Metal Ring Saves Gas 58
New Cake Pan Has Window . . 58
A Bath for Your Razor Blades . . 59
New Electric Mixer Saves Work . 59
Electric Dishwasher Has Large Capacity 59
Rolls Out Doughnuts 59
Automatic Safety Iron Stand . . 59
An Unusual Electric Fan for Your Table 59
Card Table Folds by Single Leg . . 59
Electric Range Runs Automatically 59

Photography

Send Color Photos by Wire . . . 34
Movies That "Live" 44
Stomach Can Be Photographed . . 49
Lessens Movie Film Breakage . . 52
"Movies" Preserve County Records 64

Radio

Broadcasting from Balloons . . . 35
New York's Storm Detector . . . 45
World's Biggest Vacuum Tube . . 46
"Mystery" Burglar Alarm . . . 47
Has Radio Wave All to Himself . 55
How to Choose Condensers . . . 60
Be Sure to Have a Good Ground . 60
A B C's of Radio 60

Unusual Facts and Ideas

Blowing Up a Mountain 12
Six Hundred Foot Leap by Balloon Jumper 12
Whippet Beats a Race Horse . . 12
World's Largest Submarine . . . 12
Firemen Test Water Pressure 500 Feet above Street 13
A Motor "What-Is-It" 13
Traffic Cops of Other Lands . . 30
The Story of a Baseball 31
Smoke War On in New York . . 34
U. S. Sends Most Telegrams . . 34
Cat Has Nerves Extracted . . . 35
Wealth Wasted in Lightning . . 35
Houses of Rammed Earth . . . 44
Gold Plucked from Air 45
Is Quiet Necessary for Good Golf? . 48
Ice Lowers 16-Ton Floor . . . 48
Armor for Matador's Horse . . 48
Brushes from Chinese Pigs . . . 48
To Remove Unwanted Grass . . 48
Salt Lake Changes into Fresh . . 48
Staging a Deer Rodeo 49
Ship Plastered with Oysters . . . 49
Deposits by Chute in Burglar-Proof Bank 50
Carries His Own Breeze 50
Biggest Crane Afloat 51
"Smell-Meter" to Fight Bugs . . 52
Music Sets Off Powerful Explosive . 52
Gyroscope for Giant Yacht . . . 52
Find Mummy in Ohio Cave . . . 52
Puncture Vine Spreads East . . 53
Industry Now Uses Garnet . . . 53
Recording Languages for Posterity . 55
Falling Meteor Misses Cyclist . . 56
Male Birds Hatch Eggs 56
"Wheel of Seven Sad Sounds" . . 56
You Can't Tell 'Em Apart . . . 56
Six Musical Instruments in One! . 56
A Diamond Rush in Action . . . 57
New Depths for Oil Wells . . . 57
Doll's House in Match Box . . . 57
Sixteen-Ton Bridge Holds Sixty-Ton House 57
U. S. Phones England a Sample Toot 57
Building Largest Map a Giant Task 64

Hints for the Mechanic

Holder for Small Taps Made from Auto Valve. 104
A Small Shop Method for Tapping Nuts Quickly 104
Inside Calipers Serve as Surface Gage in Emergency 104
An Angle-Iron Timber Hanger . . 104
Why a Tap Breaks 105
Measuring Angles with Extreme Accuracy 105
What Causes Chatter Marks . . 105
How to Use a Diamond for Trueing Grinding Wheels 105
Guard for Tapeline Case Made from Old Inner Tube 105
Pocket First Aid Kit Goes in Small Razor Case. 106
Expanding Chuck for Use in Finished Holes. 107
Substantial Horse for Shop Use Made of Iron Bars. 107
Grinding Chucking Reamers . . 107
How to Straighten Hardened Parts 108
Using Micrometer to Measure Work with Concave Face 108
Sheet Metal Holder Keeps Acid Bottle from Spilling 108
Lengthening Short T-Bolts. . . 108
Using Twin Angle Plates to Mount Lathe Work 109
Soft Jaws for Lathe Chuck. . . 109

Ideas for the Handy Man

A Driveway for Your Garage . . 75
Swinging Seat for Campers. . . 76
"Tuckaway" Canvas Bed 76
How to Make a Fire-by-Friction Set 76
Airplane Weather Vane. . . . 76
Rowboat Anchor for Fishermen . 76
Hammering Out a Porch Lantern . 81
Replacing Jackknife Handles . . 82
Rubber Cement Mends Torn Hunting Coat Invisibly. 82
Gimlet Bit Serves as Pipe-Cleaner. 82
Flaming Letters Light Camp . . 84
Ground Glass Substitute Easily Made 85
Building a Sturdy Porch Swing . 86
Tiny Decorative Galleon Has Walnut Shell Hull 87
How to Lock a Dial Telephone Against Unauthorized Use . . 87
Painted Glass Checkerboard . . 89
Oversize Glueing Clamps . . . 89
A Square Peg in a Round Hole. . 90
How to Solve the Popular Science Block Puzzle 90
Tool Rack of Pipe Straps . . . 90
Blueprints for Your Home Workshop. 91
Roman Candle Propels Fireworks Barge 93
High Power Fruit Press Made with Auto Jack and Rim 93
Our Viking Ship Model 94
Aerial Top Made with Spools and Clothespin 96
Acetone in the Home Workshop . 97
How to Make a Paneled Chest. . 98
Sturdy Toy Glider Folded from Letter Paper 99
C-Clamp Made from Large Nut . 99
Neat Wooden Stand Holds Watch at Night. 100
How to Grind Smooth Holes Through Plate Glass. 100
Window "Curtains" for Garage . 101
Convenient Gate Latch. 101
How to Take Care of Paint Brushes. 102
Preserving Large Corks. 103

Why Public Utility Securities are a GOOD INVESTMENT for You

By WALLACE AMES, *Financial Editor*

"WELL! Here's news!" exclaimed Fred Johnson as he and his wife sat down in the living room one evening after dinner and he started to read the local newspaper. "Our electric light company has been sold. Bought by some big interests back East. Wonder what that means. I hope we get better service. Perhaps we will, but I'll bet it will cost us more," Fred concluded rather skeptically.

Two months later. The front door opened and Fred rushed in. "Did you ever see such a night! Hear that wind! See that hail beating against the windows! Gee! I'm glad I got home! If this keeps up there won't be a tree or a wire left standing in this town by morning."

The storm's damage was worse and came sooner than Fred expected. By eight o'clock that night the electric light service was completely demoralized and every family in the town was fumbling around in candle light. "This reminds me of the hurricane five years ago," said Fred. Remember that? The electric light plant was out of commission for over a month. Wonder how long we will be in the dark this time."

Now Fred Johnson was going to find out, at least in part, what it meant to have the local light plant managed by the "big interests." Within an hour of the time that local service was interrupted by the storm, emergency messages were on their way in every direction to numerous other companies all under the same management. By morning over a hundred line-men, engineers and other workers were massed on the one job and in four days full service was resumed.

This is just one example of the effect of group management of public utility properties. There are numberless others. What does it all mean to the investor? Let us see.

THE electric light and power industry is only about forty years old. At the beginning small, independent companies were established in various towns and cities. Each one struggled along alone, as best it could, unaided by the others. Service was often inefficient, limited, undependable as also were profits to the companies.

Then the era of group management started. A number of utility properties, usually in the same territory, were brought under the control and operating management of one central organization. Generally the combined properties were in adjoining towns. A lot of small (and often weak) companies were combined together and made into one big, strong company.

With a number of generating plants connected up, better service to the entire territory is assured. If one plant breaks down electric current can be supplied from other plants without interruption of service.

One of the problems of a light and power company is to keep as even a demand as possible for current every day in the week and every hour of the day. In one community the big demand might be at night, in another case it would come in the morning, and so on. When a large territory is served by one company, or combined group of companies, it is easier to average the demand on each generating plant. During the peak demand in one community, a manufacturing center, for instance, power could be drawn from not only the local plant, but from others which otherwise would be operating at but a fraction of their capacity.

BIG companies can afford to employ more skilled engineers and managers because their services are spread over wider fields. This has resulted in improvements which small independent companies could not hope for. And, as the example related earlier in this article shows, the operating staff of each individual property is reinforced by the operating staff of the parent organization. Plant and equipment is more modernized and kept in a more perfect state of repair.

The general effect of group management of utilities has not only resulted in improved service to customers, but in cheaper service. Everyone knows how wages, cost of coal and commodities have increased since 1913. The public utilities have had to meet these rising costs. Yet the retail cost of electricity was 7.4 cents per kw.h. in 1926 as compared to 8.7 in 1913. This is a decrease of about 15%. If you take into consideration the value of the 1913 dollar present rates are about 4.2 or a decrease of 52% over rates in 1913.

Big companies, buying in larger quantities, naturally buy at more favorable prices. But this is not the only means of saving. Generating and combustion machinery has been improved under the study of skilled engineers and thus millions of tons of coal have been saved. In communities adapted to it, water power has been

A Service

for Readers of

POPULAR SCIENCE MONTHLY

THIS Department is to help readers in the establishment of proper financial programs at the beginning of their business careers; it assists those who have accumulated money in the proper investment of it so that it will be safe and so that it will grow.

The Editor of this Department is an authority on investment matters and he will not only every month give the readers interesting and useful information in his articles, but is also ready to aid in personal investment problems. Advice will be gladly given regarding the proper investment of funds and proper plans of saving.

Address all your inquiries to Wallace Ames, Financial Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York.

Any advertising appearing in this section will be carefully investigated by the Publisher of POPULAR SCIENCE MONTHLY. Readers can be sure that companies advertising are reliable and that they offer securities which represent sound financial investments. While investments obviously cannot be guaranteed by the Publisher, every effort will be made to insure that only advertisements of absolutely reliable companies are accepted.

Retire *in 15 years*

on your* Present *living Budget

by investing in safe 6½% First Mortgage Bonds

Follow the definite plan given in this book, and your financial independence is won.

The plan works just as surely, whether you are now earning $1,000 or $100,000 a year.

The way is certain—each step plainly indicated and absolutely safe—independent of luck, business genius or speculation.

Every fact has been harvested out of the 46 years' experience of Cochran & McCluer in the first mortgage investment banking business.

The plan is so simple, anyone can understand it—so definite anyone can follow it—and so certain, no one can fail.

In addition to the Financial Independence Plan and the unique budget schedule, the book gives suggestions that enable you to enjoy more of the good things of life, both while building your independent fortune and after you have attained it.

We invite the most skeptical to read this plain, straightforward, interesting book.

Send coupon. We employ no salesmen, therefore none will call.

Mail this

P-7

Cochran & McCluer Co.
46 N. Dearborn St., Chicago, Ill.
Please send me, without obligation, your book, "Behind The Scenes Where Bonds Are Made."

Name.....

Street.....

City.....*State*.....

Cochran & McCluer Co.

Established 1881—Never a loss to any investor.

46 North Dearborn Street, CHICAGO

Construction of Small Alternating Current Motors

By PROF. A. E. WATSON
Brown University

This book contains complete instructions for building small alternating current motors in several sizes. The designs will be found in harmony with those of the very best manufacturers and they can be worked out by the amateur for making useful instruments.

Fully Illustrated. **Price, $1.50**

POPULAR SCIENCE MONTHLY
250 Fourth Ave. **New York City**

Why Public Utility Shares Are a Good Investment.

(Continued from page 4)

harnessed and is producing millions of horsepower without burning coal or employing much labor.

The average yield on well secured public utility investments is coming down. According to skilled opinion this class of security will before long yield about the same as seasoned railroad investments.

At the present time well secured public utility bonds yield 5% to 5½%. Not long ago most of them were on a 6% basis or higher. It is still possible to buy public utility preferred stock to yield 7%, but many of them now pay 6½% or 6%. The investor of the future will probably not get as high a return on his public utility securities as he can get by investing today.

The leading investment banking organizations of the United States, with few exceptions, deal in public utility bonds and preferred stock. These bankers are within reach of every investor. Their offices and branches are in all principal cities and their salesmen cover a large part of the Country. And they have facilities for dealing by mail with investors who cannot easily be reached by representatives.

If you deal with a reputable investment banker (and it is not difficult to establish the fact) you may rest assured that each investment has been thoroughly investigated before it is offered to the public. An investment banker plans to be in business permanently. He is dependent on the good will of his customers. Their good will and his future depend on his selling satisfactory investments.

Most public utilities sell their preferred stock direct to the customers whom they serve with power and light. In fact this movement, known as the Customer Ownership plan, has so spread since the war that upwards of one and one-half millions of people own over twelve and one-half million shares of public utility stock.

To Help You Get Ahead

THE Booklets listed below will help every family in laying out a financial plan. They will be sent on request.

The House Behind the Bonds reminds the investor of the importance, not only of studying the investment, but of checking up the banker who offers it. Address: Fidelity Bond & Mortgage Co., 1188 New York Life Building, Chicago, Ill.

Behind the Scenes where Bonds Are Made tells how you can retire in fifteen years and have an income equal to your present living budget. This booklet can be secured by writing to Cochran and McCluer Company, 46 North Dearborn Street, Chicago, Ill.

Why Investors THE WORLD OVER *SELECT* SMITH BONDS

WHY is it that men and women all over the world, in 48 States and in 51 countries and territories abroad, are as of one mind in their choice of SMITH BONDS?

The reasons can be stated briefly: SMITH BONDS give you the essentials of successful investing—safety and ample return—6½% interest with strong first mortgage security.

Confidence in SMITH BONDS is World-Wide

These essentials are not all. Wherever the mails carry, our Mail Service Department, in Washington, D. C., enables you to have your investments handled by mail with the same individual attention and cooperation that you would receive if you called at one of our offices.

6½% whether you invest much or little

Another reason: Denominations of $1,000, $500 and $100, and Investment Savings Plan payments of $10, $20, $30 or more a month, place 6½% SMITH BONDS within easy reach of every investor. Regular monthly payments earn the full rate of bond interest.

Mail the form below for two booklets—one explaining the safeguards that protect every investor in our First Mortgage Bonds, the other showing how your monthly savings will grow at 6½%.

THE F. H. SMITH CO.

Founded 1873

SMITH BLDG., WASHINGTON, D. C.
285 MADISON AVE., NEW YORK, N. Y.
CONTINENTAL & COMMERCIAL BANK BLDG., CHICAGO, ILL.

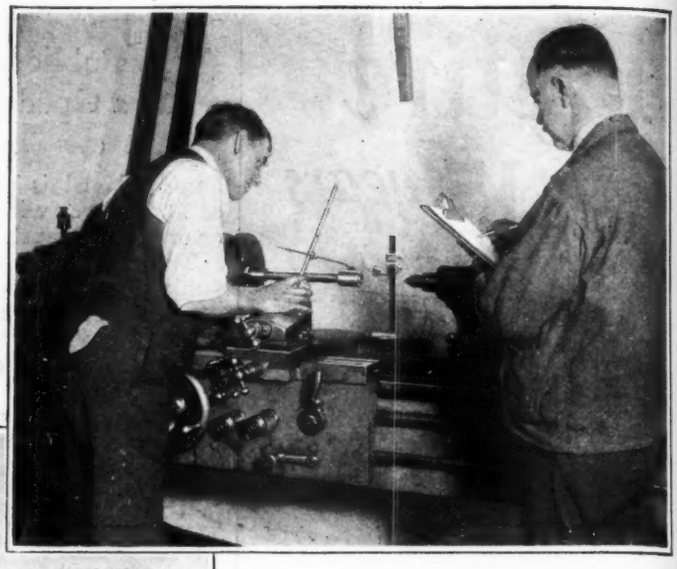
PHILADELPHIA BOSTON ST. LOUIS PITTSBURGH BUFFALO MINNEAPOLIS ALBANY

Name 75

Address .....

What Is a GOOD LATHE?

By
CARLOS DE ZAFRA, M. E.
Assistant Director
Popular Science Institute of Standards



Engineers are here shown testing a lathe in the laboratory of the Popular Science Institute of Standards. These tests cover some forty points and determine definitely whether the lathe is a good one or not

THERE is just as much difference between a good lathe upon which accurate work may be turned out and a poor one, as there is between any other good and poor quality tool. Small parts for model making, and repair parts for precision work cannot be accurately turned out from a cheaply made lathe.

And, in order to determine the accuracy of a lathe, there are a great number of items which must be checked upon—the exact number depending on the simplicity or complicity of its design and type. To perform all the various tests that the Popular Science Institute of Standards considers essential for a thorough check-up of a lathe requires considerable equipment including squares, gages, arbors, scribes and so forth.

Among the first things done is to determine the setting of the lathe by longitudinal and lateral leveling. The swing over the "V's" and over the carriage, and the maximum distance between centers give a check upon the capacity of the lathe.

Next, the Institute checks up on the fitting of the headstock, the tailstock, and the carriage on the "V's" is checked up, as these should fit snugly and yet permit of easy adjustment without play.

AMONG other items about which the tester must satisfy himself are: Have the headstock, tailstock and carriage been planted properly, the "V's" shaped to the proper angle and the "V's" of the bed scraped true and straight? Is the live center exactly true, and is the center bearing in the live spindle axially true with its spindle? Is the live spindle exactly parallel with the "V's" in both horizontal and vertical planes?

Does the carriage move exactly at right angles to the "V's"? Is the tail spindle exactly parallel with the "V's" in both the horizontal and vertical planes? Are the head and tail centers exactly in line? Is the faceplate exactly true? Is the faceplate exactly at right angles to the line of centers?

In all, there are some forty points of inspection on the ordinary screw cutting lathe while a still greater number must be checked in the case of lathes with special attachments and accessories.

In addition to the above, careful inspection and examination are made by the Institute of Standards' Engineers to ascertain the appearance of scraped and of polished surfaces, as to finished corners being properly rounded, width on cone steps, change gears fitting stud properly, and uniformity of size of squires for wrenches.

AFTER such inspection, the lathe is actually operated and employed in doing some work which will determine the degree of accuracy of its work, as a check against whatever the previous inspection may or may not have disclosed. In short, the testing of any machine tool is very much like the thorough physical examination that a physician gives a patient. Certain characteristics are looked for first of all, and the examination is progressive and complete. A lathe that can successfully pass such tests is necessarily a good one that can be safely purchased.

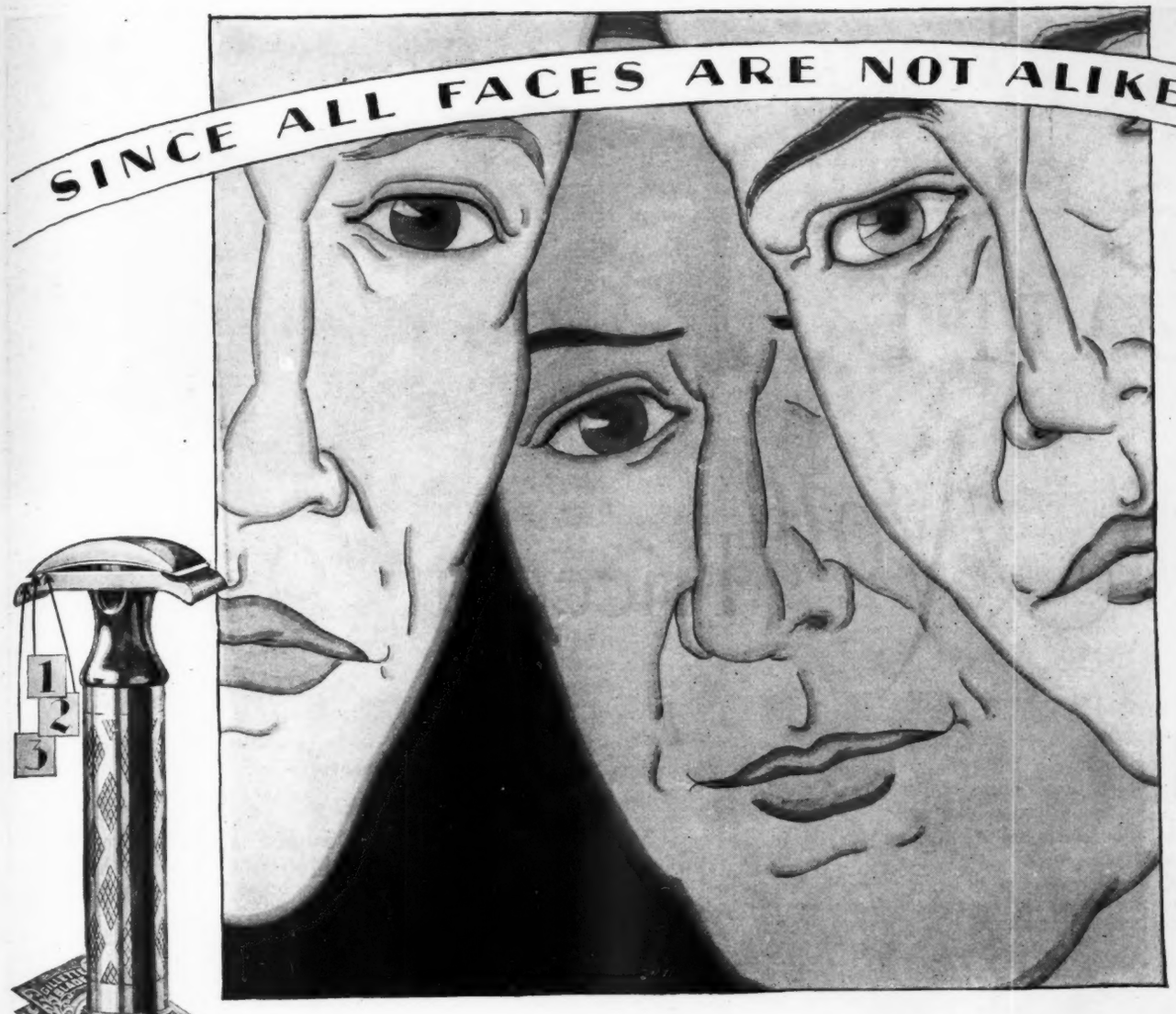
The Popular Science Institute has prepared a list of the machine and hand tools that have its approval as the result of satisfactory test findings. This, and also similar lists of radio and oil burning equipment are available on request. Readers of the magazine who wish to obtain such lists or would like information about these different types of equipment should address their inquiries to the Popular Science Institute of Standards, Two hundred and fifty, Fourth Avenue, New York, New York.

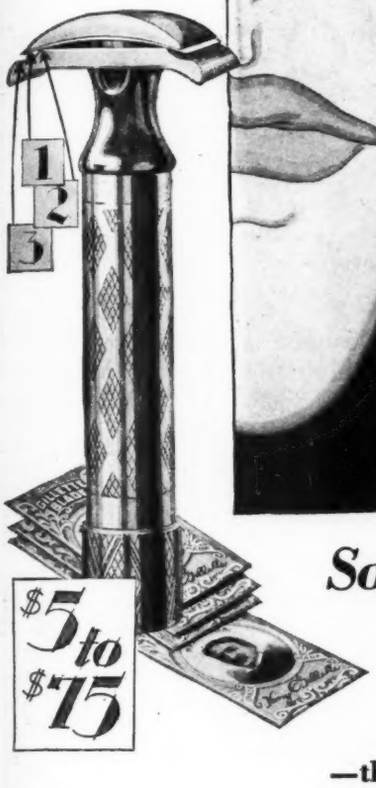
Popular Science Monthly
GUARANTEE

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

POPULAR SCIENCE MONTHLY guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in POPULAR SCIENCE MONTHLY may expect them to give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by POPULAR SCIENCE MONTHLY. THE PUBLISHERS

SINCE ALL FACES ARE NOT ALIKE





Some men hurry . . . others take their time

—the nature of the skin and beard of every man differs from his neighbor's.

The New Improved Gillette makes shaving comfortable and enjoyable to ALL. It has 1 a shaving edge with ample space beneath to receive shaved hair and lather without clogging; 2 an adjustability of shaving edge so precise as to suit any skin and beard; 3 a micrometric exactness of dimensions that makes it *the hand-tailored razor for your face* . . . Get a New-Improved Gillette today and your shaving troubles are over.

THE GILLETTE SAFETY RAZOR CO.
BOSTON, U. S. A.

Whether you have a beard "like wire" or as soft as silk, your GOOD shave will become a PERFECT shave if you read "Three Reasons." On request we will gladly send you a copy, free.

MADE IN U. S. A.
TRADE Gillette MARK
KNOWN THE WORLD OVER

Five-tube set for aerial or loop.

Now Priced at $95

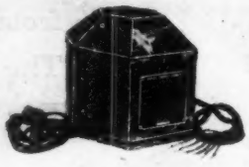
LARGE sales and consequent lowered manufacturing costs now enable dealers to offer the Grebe Synchrophase at $95.00.

Only the price is changed. There is the same remarkable tone quality and reception efficiency — the same easy station finding of its *one dial control* — that have long made the Synchrophase the dominant receiver in the better set field.

Send for Booklet P. Then have your dealer demonstrate the exclusive Grebe features.

A. H. Grebe & Co., Inc.
109 West 57th St., New York City
Factory: Richmond Hill, N. Y.
Western Branch: 443 So. San Pedro St., Los Angeles, Calif.
The oldest exclusive radio manufacturer

The GREBE SYNCHROPHASE RADIO
TRADE MARK REG. U.S. PAT. OFF.



Grebe Socket Power

Dependable "B" and "C" power, ample voltage to operate 180-volt power tube; self-adjusting, quiet. For any 5- and 6-tube receiver and the Synchrophase Seven; 110 volts, 60 cycles A.C. Without BH Raytheon tube, $50.

GREBE RADIO
TRADE MARK
REG. U.S. PAT. OFF.

Popular Science MONTHLY

FOUNDED 1872 — FIFTY-SIXTH YEAR

JULY, 1927 SUMNER N. BLOSSOM *Editor* VOL. III, NO. 1

Wireless Power—The Next Great Invention

Electrical Experts, in Amazing Experiments, Reveal How Radio Beams Soon May Light and Heat Our Homes

By ALDEN P. ARMAGNAC

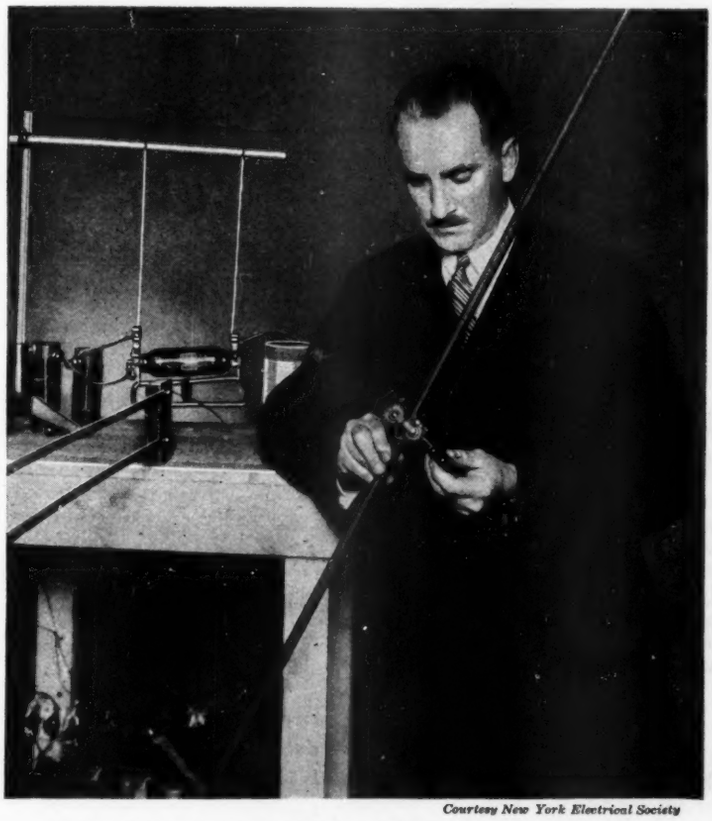
IN A New York lecture hall a few nights ago, a group of engineers watched a scientist raise in his hand an electric light bulb. To it was attached a four-foot copper rod. A short distance away a radio vacuum tube was turned on—and instantly the bulb glowed brilliantly!

This was "radio power," dream of scientists. On a laboratory scale, Dr. Phillips Thomas, research engineer of the Westinghouse Electric and Manufacturing Company, had demonstrated before the New York Electrical Society how near scientists had come to the transmission of energy without wires between cities and across country.

Tomorrow, radio beams of power may light and heat your home. Electric waves surging without wires through the earth and the ether may drive airplanes, automobiles and trains. Instead of the present uneconomical use of coal in small power plants scattered through every country, a few monster central stations may generate all of the world's power, which may be tapped by an aerial or a grounded wire at any point on the earth's surface. Isolated homes as well as the factories of a metropolis will share equally in the wealth of available power by wireless.

Such a prophecy for the future is well within the limits of possibility, in this wonder age of science. A few months ago, no one dreamed that soon you would be able to see by radio—yet now we have television! Will radio power be the next great invention? Many scientists are at work on it today—and at any moment it may be realized on a practical scale.

The idea of transmitting power without wires is not new. Heinrich Hertz, discoverer of radio waves, tested its possibility and found it feasible. Nikola Tesla, celebrated inventor, who devised a system of wired power to transmit alternating electric currents, now in use throughout the world, has experimented in the field for years. Even now he is designing an amazing wireless power plant to be erected at Niagara Falls. Dr. Charles Steinmetz, one of the greatest electricians the world has known, was a firm believer in future wireless power and suggested a method by which it might be achieved. Senator Marconi, father of radio communication, adds his expert opinion that power by radio is near.

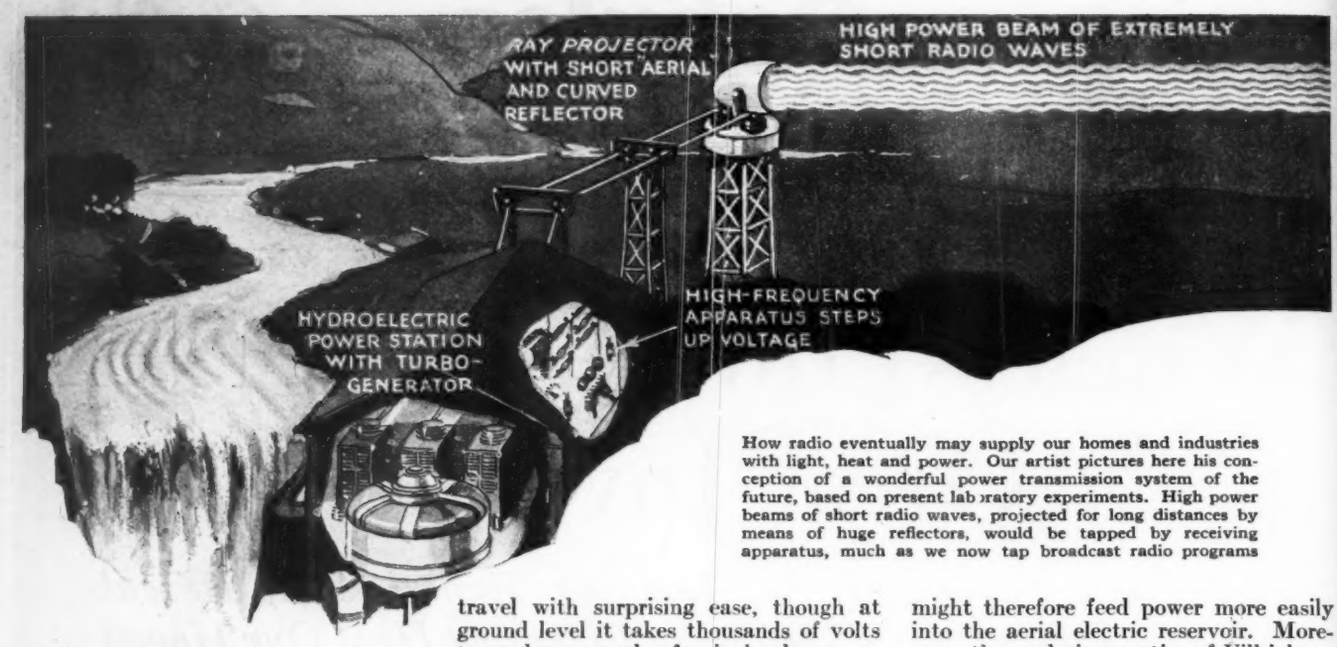


Courtesy New York Electrical Society

Wireless light and power already have been achieved in the laboratory. Here Dr. Phillips Thomas, research engineer of the Westinghouse Electric and Manufacturing Company, is using radio impulses from the vacuum tube at left to light a small electric lamp attached to a copper "aerial" rod

ONLY recently Marconi told the Institution of Civil Engineers in London that the transmission of power by electrical waves awaited only the perfection of devices for projecting the waves in parallel beams in such a manner as to minimize dispersion and diffusion of the energy into space.

The ordinary broadcasting station projects random waves in all directions that follow outward paths like the spokes of a cartwheel. A few miles away, you could not collect power enough to run your watch. But Marconi has invented a radio reflector that concentrates the waves in one direction, bunching them all together, as between two adjacent spokes of the wheel. In his system a


RAY PROJECTOR WITH SHORT AERIAL AND CURVED REFLECTOR
HIGH POWER BEAM OF EXTREMELY SHORT RADIO WAVES
HIGH-FREQUENCY APPARATUS STEPS UP VOLTAGE
HYDROELECTRIC POWER STATION WITH TURBO-GENERATOR

How radio eventually may supply our homes and industries with light, heat and power. Our artist pictures here his conception of a wonderful power transmission system of the future, based on present laboratory experiments. High power beams of short radio waves, projected for long distances by means of huge reflectors, would be tapped by receiving apparatus, much as we now tap broadcast radio programs

number of short "aerials" are arranged in a curved row at the back of the main broadcasting antenna, to reflect the waves it emits in a beam with parallel or, at most, slightly fan-shaped edges. Between London and Canada, and elsewhere, this type of "beam radio" has produced strong signals for radio telegraphy, at a distance where ordinary signals would be weak and inaudible.

A "magnifying transmitter," that hurls electric currents at millions of volts into the earth, to be recovered as power at any point on its surface, is the invention of Nikola Tesla.

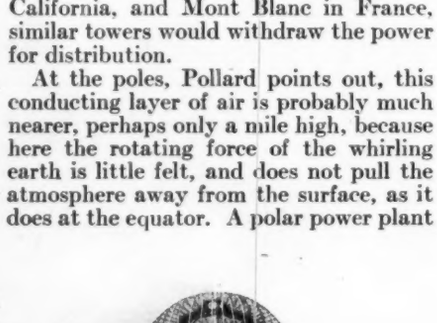
"The transmission of power without wires is not a theory or a mere possibility," this wizard of electricity told me recently. "It is a fact which I myself have demonstrated in numerous practical experiments, conducted on a large scale with a generator of 1500 kilowatts capacity. As long ago as 1899 I found that the current from my magnifying transmitter traverses the globe and returns to its origin with undiminished strength. This afforded evidence that there was virtually no loss in the transmission through the earth; and that by a properly organized apparatus at the sending and receiving stations, power in industrial amounts could be transmitted with an efficiency as high as ninety-nine and a half per-cent."

TO TRANSMIT power through the earth, Dr. Tesla said, he plans to erect at Niagara a huge tower similar to the one he had partially completed on Long Island, N. Y., when it was destroyed at the outbreak of the European war. Contrary to popular opinion, neither that nor the improved structure he proposes is a radio tower. Like some gigantic pile driver, it will jar the earth, not the air, with artificial thunderbolts manufactured in its mushroomlike dome.

In the sky, as well as the earth, may lie the secret of wireless power. A study of huge sparks, some of them 400 feet long, that Tesla has produced in his laboratory, has shown that in the rarefied upper atmosphere electricity could travel with surprising ease, though at ground level it takes thousands of volts to produce a spark a few inches long.

Other experiments have shown that the levels at which such a flow of electric power could be produced are within a reasonable distance of the earth,—say 30,000 feet above sea level. This has led Hugh Pollard, a British engineer, to suggest monster towers reaching into the clouds and topped by captive balloons, to feed power at millions of volts into the vast conducting layer of the upper air. At other points on the earth's surface, such as Mount McKinley with its 20,000 foot peak in Alaska, Mount Whitney in California, and Mont Blanc in France, similar towers would withdraw the power for distribution.

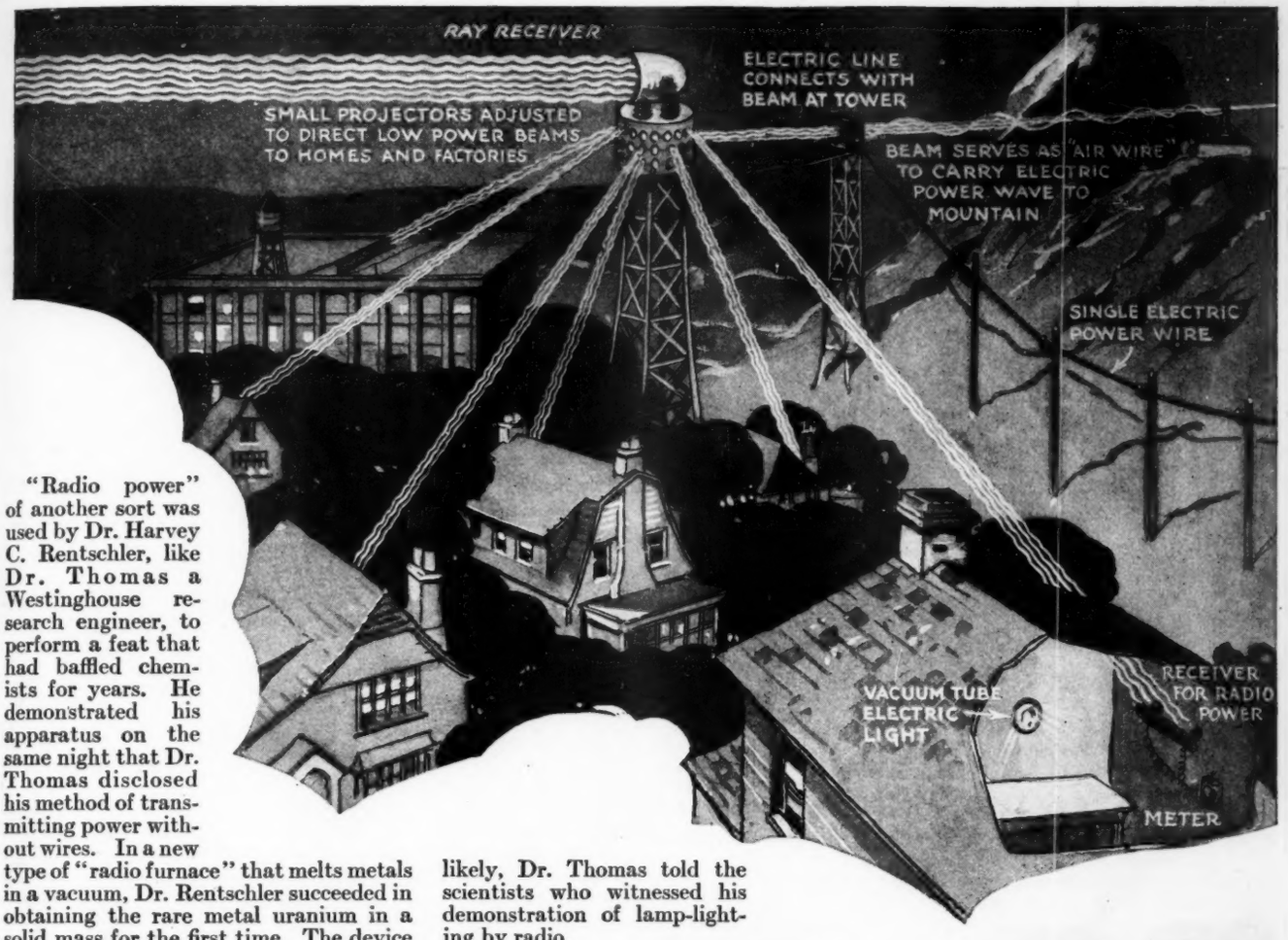
At the poles, Pollard points out, this conducting layer of air is probably much nearer, perhaps only a mile high, because here the rotating force of the whirling earth is little felt, and does not pull the atmosphere away from the surface, as it does at the equator. A polar power plant might therefore feed power more easily into the aerial electric reservoir. Moreover, the exploring parties of Vilhjalmur Stefansson and of Capt. Donald MacMillan in the Far North, and of Sir Ernest Shackleton, Roald Amundsen, and Capt. Robert F. Scott in Antarctic regions have reported that vast stores of coal, and occasionally oil, exist near the poles. There would be no lack of fuel, then, to run the plants—fuel that now lies unused simply because the cost of transporting it to civilization would be too great.



The famous power tower at Shoreham, Long Island, designed by Nikola Tesla to transmit thousands of horsepower through the earth. It was dismantled at the outbreak of the European war. The inventor now plans to construct a similar tower at Niagara Falls

HOW well the theory of a low conducting air level at the poles agrees with fact is likely soon to be known. Arctic explorers invariably return with accounts of strange displays of northern lights—a weirdly beautiful electric phenomenon still not fully understood, but known to have a definite connection with the electrified upper air. The most recent polar expeditions have collected masses of scientific data taken from auroral observations, which may confirm the existence of such a low-hanging layer.

The amazing system of wireless power proposed by Dr. Steinmetz, the exact opposite of Tesla's "earth power," was to girdle the earth with power from the outside instead of from within. A broadcasting station, he said, might emit a wave of tremendous strength—millions of horsepower—that would circle the earth and return to its starting point. If the wave length were properly chosen, such a wave would have lost only a small part of its power by the time it completed its journey, and would continue its circuit many times. The broadcasting station would time its successive waves so accurately that the first one returned at the exact moment that a similar one was being sent out. The only additional power required, then, to keep the waves going would be to make up the slight loss in transmission, as long as no power was being withdrawn. When some receiving station "tuned-in" to withdraw the wireless power, it would "leave a hole in the wave" that the broadcasting station would make up by supplying an additional amount. Many stations scattered over the world could feed power into the wave, each one carefully timed to emit its waves just as the main wave passed by.


RAY RECEIVER
ELECTRIC LINE CONNECTS WITH BEAM AT TOWER
SMALL PROJECTORS ADJUSTED TO DIRECT LOW POWER BEAMS TO HOMES AND FACTORIES
BEAM SERVES AS "AIR WIRE" TO CARRY ELECTRIC POWER WAVE TO MOUNTAIN
SINGLE ELECTRIC POWER WIRE
VACUUM TUBE ELECTRIC LIGHT
RECEIVER FOR RADIO POWER
METER

"Radio power" of another sort was used by Dr. Harvey C. Rentschler, like Dr. Thomas a Westinghouse research engineer, to perform a feat that had baffled chemists for years. He demonstrated his apparatus on the same night that Dr. Thomas disclosed his method of transmitting power without wires. In a new type of "radio furnace" that melts metals in a vacuum, Dr. Rentschler succeeded in obtaining the rare metal uranium in a solid mass for the first time. The device that accomplished this remarkable result and thereby inaugurated a new science—"radiochemistry"—was designed to focus a large quantity of radio power in a small space, rather than transmit it to a distance.

When Dr. Rentschler threw a switch that turned on the current, radio waves from a powerful electric coil pierced the emptiness of the vacuum to generate a terrific electric current in a small capsule of impure powder containing uranium. There was a flash, and incandescent metal swelled to a molten mass. When it cooled, Dr. Rentschler was the first man in the world to see what this extremely heavy metal looked like. Much like iron in its grayish appearance, it was far more precious than platinum.

Other rare metals of like properties yielded their secrets to Dr. Rentschler when placed in the vacuum and heated by radio waves. The new furnace is of inestimable value to chemists, who can now watch reactions they could never see before—that can take place only at high temperatures, in a vacuum.

With radio power in a test tube already achieved, will the next step be radio power in your home? Very likely, Dr. Thomas told the scientists who witnessed his demonstration of lamp-lighting by radio.

Already he can transmit power without wires over a short distance. With improved vacuum tubes and electric circuits, he said, he hoped to improve his power transmission until he produced a type of wireless wave that would yield a space-annihilating beam over which huge quantities of power might be sent.

Short radio waves, ten thousand times shorter than those used in broadcasting, are the means Dr. Thomas will use. His goal is a "beam radio"—but a beam unlike any that has ever been produced. If he can make his radio waves short enough—and powerful enough—he will focus them to a narrow, four-inch ray by means of a curved metal mirror!

Then he will project his beam, like a searchlight, to its destination. Such rays would criss-cross a city, and wires would become obsolete. Each home would have its own "rod receiver," a short copper wire, resembling the one Dr. Thomas used in his demonstration, with which you could tap the power flowing through the ether just as you now listen-in to music with your radio set.

The idea of reflecting radio waves with mirrors may seem a little startling, but your own experience will yield the evidence in its favor. The silvered reflector of your car's headlight concentrates its rays in a parallel beam. Light waves and radio waves are closely related to each other, differing only in their length; the waves of light are much shorter. Could radio waves, like light, be focused?

In between light and radio are heat waves—of medium length. Like light waves, they too can be

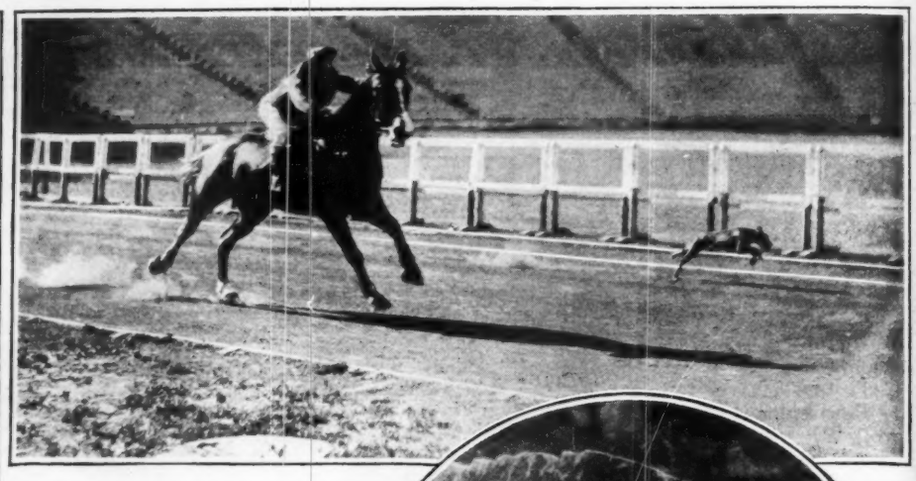
(*Continued on page 114*)

Courtesy New York Electrical Society

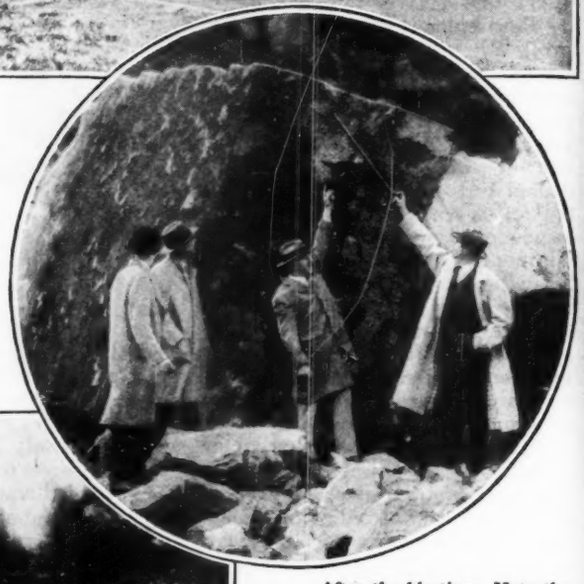
A remarkable concentration of radio power. Dr. Harvey C. Rentschler, Westinghouse research engineer, demonstrates his new type of "radio furnace" which melts metals in a vacuum. Powerful radio waves from the electric coil above Doctor Rentschler's hand penetrate the adjacent vacuum tube and generate a terrific current in the metal within

Pictorial News *of the* Month

Cross-country hiking by balloon is the latest sport. With all but five pounds of his weight supported by a balloon, a man can leap with fantastic ease over houses, trees and streams. In the illustration, a balloon jumper of Berlin is seen descending from a record 600-foot jump

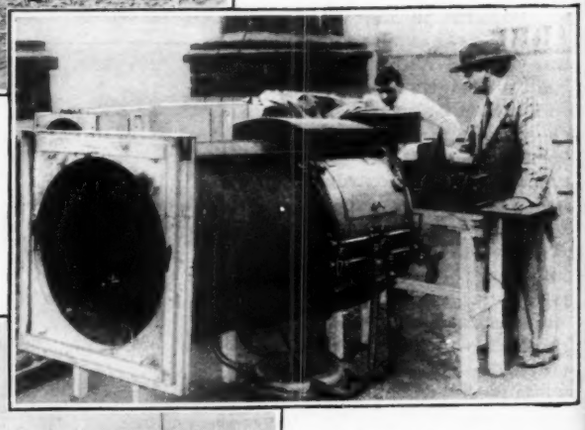


A whippet lost to a horse the other day, in a feature race at the first national meet of the Pacific Coast Whippet Association. Arroyo Sloe Eyes, a California bred dog, beat all his canine competitors but, matched against a race horse, Clockwork, lost over a 200-yard course. Photo shows Arroyo and Clockwork racing



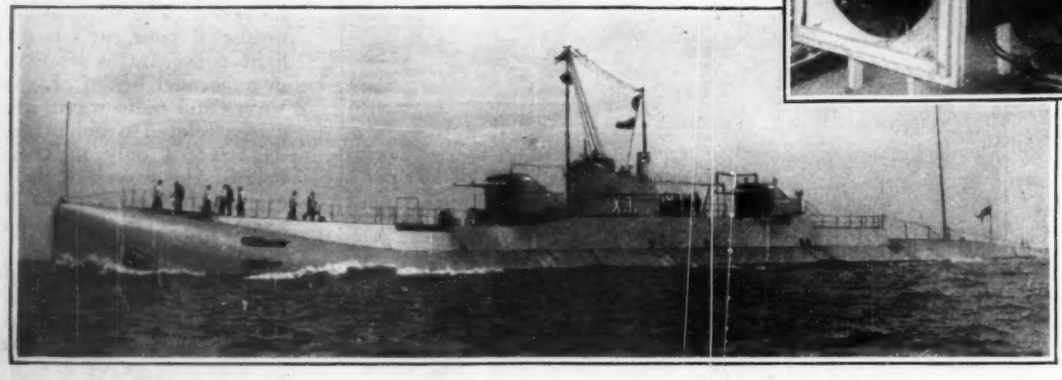
After the blasting. Note the size of the rocks into which the mountain was split. The dynamite had been planted in 200 holes in the rock

Boo-oo-m! At the sound of the blast, a whole mountain blows up and tons of rock hurtle skyward! A New York road building company used this novel method of obtaining rock for roadbeds. The mountain was solid rock, 75 feet high, 900 feet long. Photo shows it right after blasting



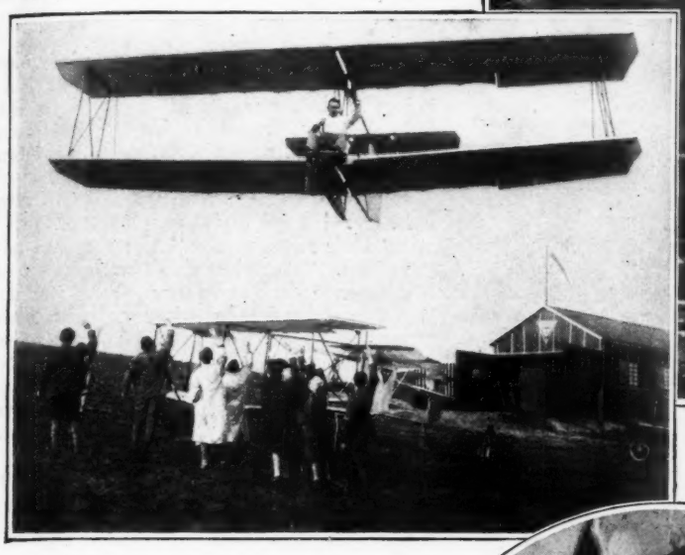
Ships sighted in fogs, smoke pierced at a glance—these are the latest wonders of television in its newest form, noctovision, promised by John L. Baird, Scotch television pioneer. Baird is seen above with the apparatus with which he has demonstrated these marvels

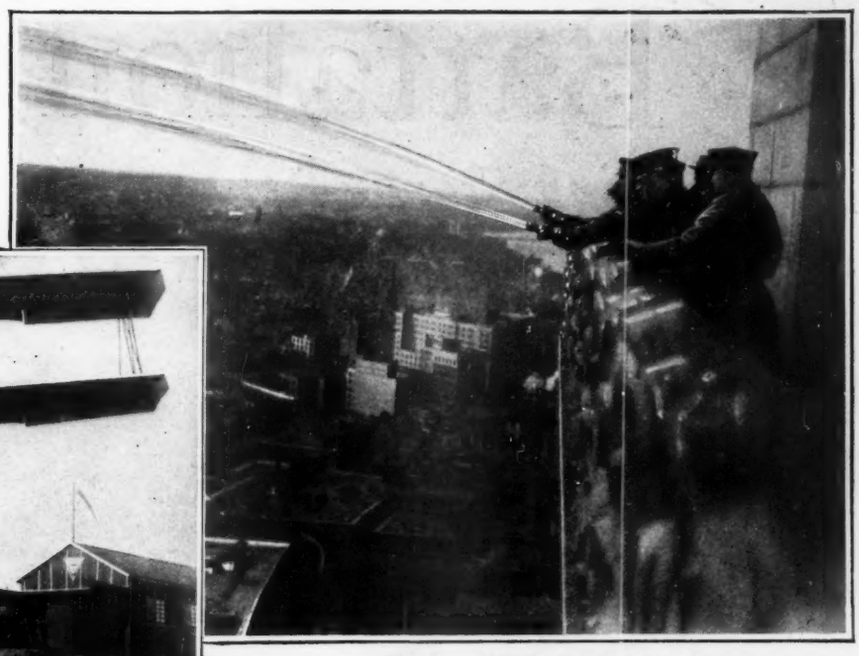
Great Britain is the proud possessor of the world's biggest and fastest submarine, pictured below—the *X1*, just launched. A commerce raider with the speed of a destroyer, it boasts a powerful armament and has a displacement of 8600 tons



Cross-Country Hiking by Balloon—Britain Builds Largest Submarine—Blowing Up a Mountain—Ingenious Inventions

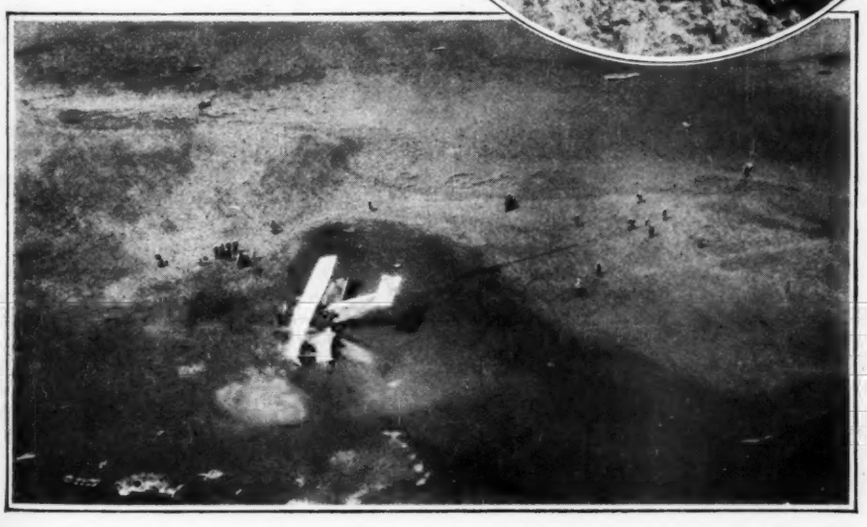
Flights in homemade gliders, or motorless airplanes, have become so popular in Germany that clubs have been formed, the members of which build their own machines and hold competitions. The flyer starts at the top of a hill, and, racing down the slope, swoops into the air. By careful balancing he can take advantage of wind currents to remain in the air a surprising length of time, as the aeronaut below is demonstrating





Boston gave its water supply a high pressure test the other day that reassured the city considerably in respect to the danger of fire in its tall buildings. This spectacular test was made in the Custom House Tower, and the water was forced to the height of 500 feet—far above the roof level of the city

A tragic ending to one trans-Atlantic flight attempt occurred at Langley Field, Va., when the plane that was to carry Commander Noel Davis to Paris crashed to earth during a test. Davis and his companion, Lieut. Stanton H. Wooster, were instantly killed when the plane buried its nose in the ground, as shown in the photograph below, taken from another plane a few minutes after the fatal accident. At right may be seen the mass of debris, all that was left of the forward part of the plane, including the cockpit in which they were sitting. Overloading was blamed for the wreck



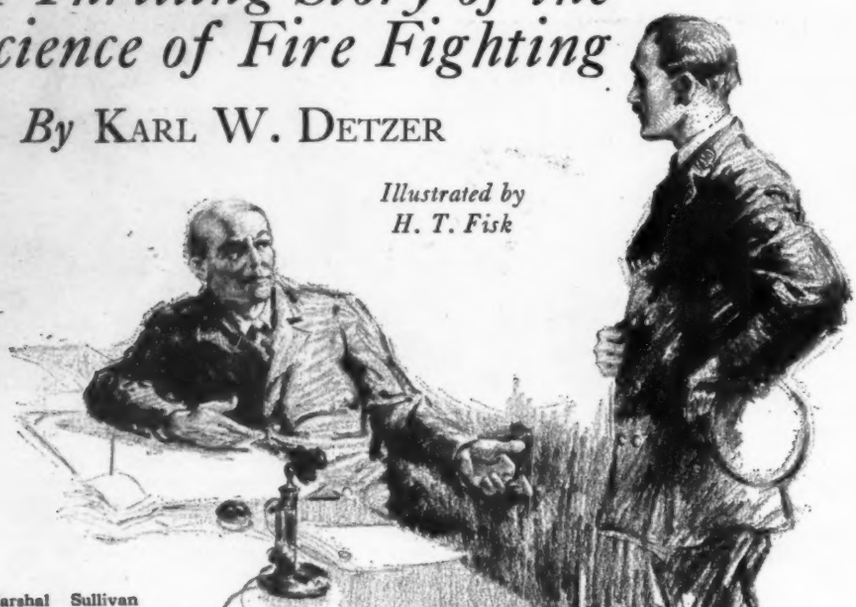
This remarkable vehicle is probably the smallest and oddest motorcycle in the world. It consists mostly of one large front wheel into which is built a one-cylinder motor. The gasoline tank is a can located below the handlebars. The brakes are nonexistent, the driver stopping his machine when necessary by dragging his feet. Remarkable speed, however, is claimed for it by its inventor, William Nichols, of Massachusetts Institute of Technology

Chief of Battalion

A Thrilling Story of the Science of Fire Fighting

By KARL W. DETZER

Illustrated by H. T. Fisk



Marshal Sullivan spread out his big hands in a gesture of failure. "Kellogg," he said, "when you get the job, don't be hard on the old man"

THE fire marshal, whose name was Peter G. Sullivan, scowled at the report of his first assistant.

"Just the two of 'em?" he demanded. "Nobody else?"

"Just the two," the first assistant affirmed. He stood across the desk from his chief. Sullivan was a huge man, overlapping his chair, with hands like mallets and a face like a sun-cured ham. The assistant was the taller of the two, just as old, but with less meat on his bones. "I tried to talk Kellogg out of it," he complained. "But you know these young Johnny-Jump-ups—no stoppin' them! And civil service commission watchin' us close. Was we to try a bit of fancy work to keep Kellogg from climbing over the head of old Dargan, they'd be on us like a fallin' wall."

"Send 'em in, one at a time," the marshal commanded.

Captain Kerry Dargan, Fire Engine Company 14, strode determinedly into the bare quarters of his chief. He carried his uniform cap in his hands, and the marshal noted that the two nickel-plated bugles on its peak had been polished carefully for this occasion. He was a short, knotty veteran, this Captain Dargan; his shoulders were square, and his jaws; even the toes of his stubby, black shoes were cut straight across.

"Mornin', Chief," he said. His voice rumbled across the room.

"Hello, Kerry." The marshal pushed a cigar toward the captain of Engine 14. "Smoke?"

Dargan dragged a chair nearer. "Thanks, Pete," he said.

"Kerry," began the marshal, "I hear you're goin' up for battalion chief. I was wonderin'. How old are you now?"

"Fifty-seven, Chief."

"How long you been captain?"

"Twenty-six year, come March."

The marshal turned slowly, searching for his cuspidor; searching, too, for an argument to dissuade his old friend from risking defeat in competition with the younger man.

"Examinations is kind of stiff, Kerry," he said. "This here new civil service board . . . no sense to it or anything . . . but a fellow can't get by no more just bein' a good fireman."

"No," Dargan agreed. "Ain't like the old days in the department. But I know my stuff. Been studyin' hydraulics. Kind of hard rememberin' such nonsense, but I'm goin' to take a chanct. Can I break even on the book questions, I'll drown that guy out on the fire business stuff."

"Sure," the marshal conceded, "only puttin' out fire and writin' about it is different."

"'COURSE it is!" Dargan's voice boomed louder. "But that Kellogg! He's a sufferin' disgrace to the bugles on his hat, tryin' for battalion chief, young as he is. Why, it ain't ten year since I give him his first dose o' smoke. Captain already, and wantin' to be chief! I got my stomach full o' him!"

"He's right young," the marshal admitted. "But that don't make a lot of difference on this paper stuff. Board's got to judge 'em fair, Kerry. If he beats you today . . . well, you'll always feel bad about it. Why don't you leave good enough alone? Go back to your company. I'll give you ten days extry leave on your vacation. You ain't far from pension. . . ."

"Not by the holy hydrants I won't! Take to the air for him? Why, that boy can't wet down a roof, Pete. Ain't got the beginnin's of a bat chief!"

The marshal sighed. He had known it would be no use. He spoke hurriedly, knowing also the extravagances of Captain Kerry Dargan's temper.

"Up to you, Kerry, up to you! I stand in nobody's way, and you know me long enough to be sure of it. Shake, Kerry. Best luck. But, Kerry . . . hydraulics, it's a tough proposition to tackle!"

Captain Dargan tramped out of the room. Thirty seconds later the trim, young, confident figure of Captain John Kellogg advanced to the marshal's desk. He lifted his right hand sharply to a proper salute that betokened military training.

"Captain Kellogg reports, sir," he said, and stood at ease while the marshal studied him. He was not more than thirty-two or three. His eyes, which were light gray, did not falter as they met the chief's.

"Goin' up for battalion chief, Kellogg?" the marshal asked. He did not offer this captain a cigar. "Well, there's been a vacancy a long time in stockyards battalion, you know. Near two years. Captain Dargan's been handlin' the job of actin' chief pretty good, don't you think?"

"Yes, sir."

"DARGAN'S a good fireman. Knows his stuff. But he ain't got book learnin'! Now, Captain, I don't say it ain't right and proper for you to go up ag'in' him. I don't know what else you can do. But . . . don't you see, Kellogg?"

"See what, sir?"

Again the marshal turned and searched his cuspidor.

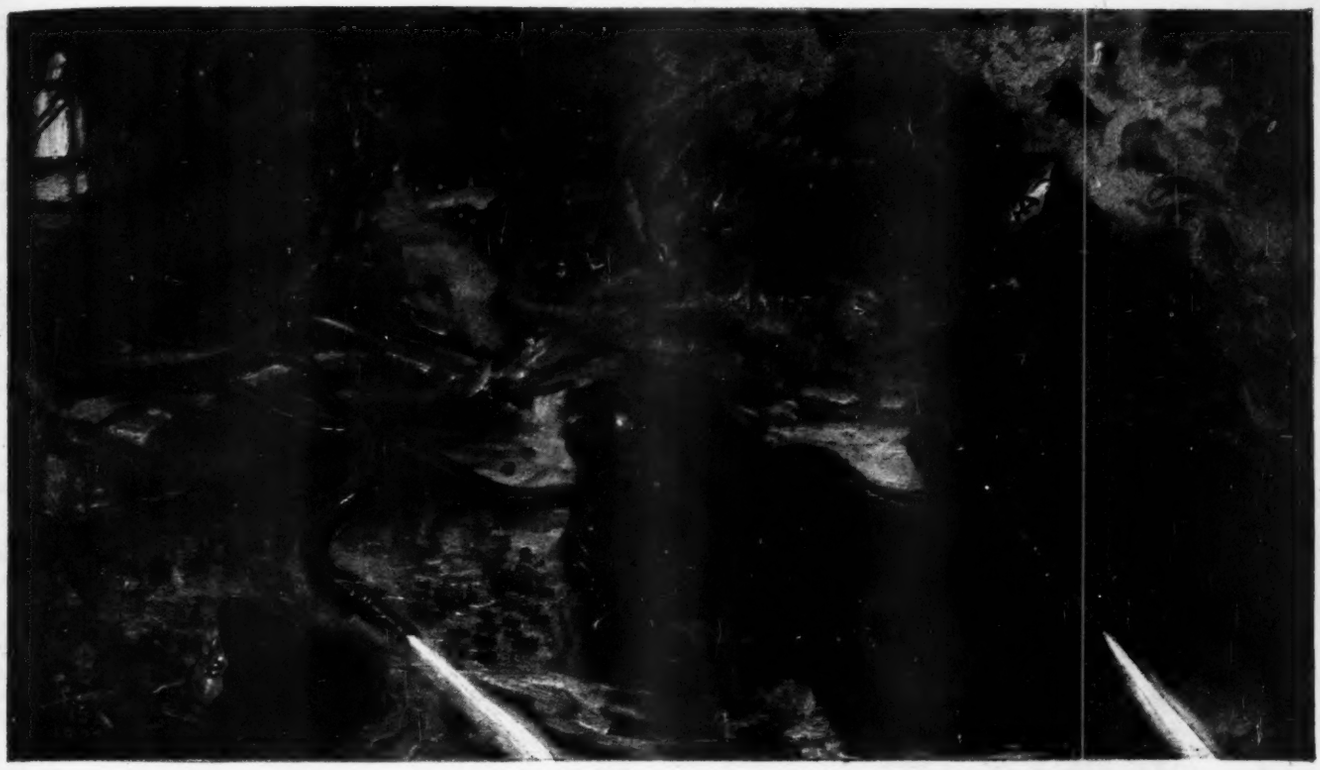
"'Course you'll beat him," he said confidentially. "He ain't comfortable with a fountain pen. And hydraulics is hard for an old man."

"I have some trouble with hydraulics, too, sir."

"Listen, Kellogg. If you don't go up for promotion in your battalion, and nobody else does, it still leaves a vacancy. Old Dargan will hold it, actin' chief. Then after a bit, three or four years, he'll retire on pension. And you'll have the job to yourself."

"The vacancy is there now, sir. Best man ought to get it."

"Married, Kellogg?"



Kellogg lay on the hot floor . . . ammonia was knocking him out . . . how could old Dargan stand it? He heard a warning shout and saw Dargan rise to his knees. An immense wrench of timbers thundered above the noise of the fire. "Cut off!" Dargan cried

"Not yet, sir. Can't afford to. Battalion chief makes more money. Maybe then . . . "

"All right!" Marshal Sullivan spread out his big hands in a gesture of failure. He had known this would be no use also. "I'll put nothin' in your way. But Kellogg . . . when you get the job, don't go bein' hard on the old man. He's a good fireman. Give all his life to the business. Go easy on him." He paused, scratching his chin. "Lots o' young officers with old men under 'em . . . "

Again he paused, and this time indicated that the interview was over.

FIVE hours later the first assistant marshal looked up thankfully at the clock in the examining board room. Before him at two tables sat the two candidates for the office of battalion chief in the stockyards district. Dargan had finished his examination paper with twenty minutes to spare. Young Kellogg still added sums, multiplied, strove with intricate fractions. There had been five problems in hydraulics.

"Time's up," the assistant marshal said. Two other members of the board put down their magazines and strolled over from the windows. They folded the completed examination papers and stuffed them into manila envelopes, which they sealed with wax.

Captain Kellogg turned to his elderly rival.

"Hard one, wasn't it?" he said. He tried to be casual.

"Yeh," Dargan answered gruffly. "'Rithmetic ain't for grown-ups."

'I mean the fire problems."

"Oh, them? No . . . easy."

Captain Kellogg frowned. "I didn't think so," he said. "That one on Schwart's beef house . . . here . . . fighting a fire in the cellar of Schwart's beef house, if you were chief of battalion and first in. It nearly got me."

"That's easy," Dargan disputed. "All you can do in that old trap is go in and drown it, 'lest it gits too hot. Then yank your companies out, far enough so's the walls won't hit 'em."

Kellogg drew a comb from his pocket and ran it through his hair. Dargan bit off a mouthful of tobacco.

"I've always worried about that beef house," Kellogg confessed. "Thought about it a lot . . . hard place to fight fire. How'd *you* say you'd distribute first alarm companies?"

Captain Dargan glanced at the younger officer scornfully. This youngster might understand the books, but he didn't know the fire business.

"Nach-eral way," he said. "You drive in from the south, don't you? Beef house backs up on the river. Good enough. If the fire's in the basement, hit the two main south doors. First two companies . . . send 'em in there. First truck company to roof and up the sides to ventilate."

"Ventilate right away?"

"Sure . . . ammonia in there . . . ventilate right away. Third company in to foot of elevator shaft, passin' first two companies. There's where your fire will be. Fourth company follow 'em. Then have your truck take a second line off pumper, to roof. Use your squad for whatever else there is, but have smoke helmets handy. Don't give squad a line; have 'em ready with smoke helmets. That's how *I* done it."

"I brought them in from the north," Kellogg said thoughtfully.

"North?" Dargan spat. "Yeh, suppose you would. That's the trouble with young fellers. Climb over all them fences to get round behind it. You'd have plenty of water, north, on second alarm. Two fire tugs."

"The examination says it's a windy day," Kellogg added stubbornly. "We wouldn't have the smoke in our faces, north side." He was snapping a rubber band around his note paper.

Dargan looked at him disdainfully.

"Leave the best man win," he grumbled, and didn't see Kellogg's outstretched hand.

"You won't hear from these for a couple of weeks," the first assistant explained. "Got to have regular meeting of board first, before we break the seals. Goodbye, Dargan. Goodbye, Kellogg."

CAPTAIN JOHN KELLOGG discussed the whole examination that night with his crew on Engine 26. It was a warm evening, early in August. The broad front doors of the company quarters stood open to a noisy street. In the apparatus room young Jim Burton sat on duty before the busy alarm instrument board. Outside, where it was cooler, white-haired Hennessey, with a face like a monk's and the vocabulary of a wharf rat; McSweeney, who had served eighteen years in the same company; Stein, whose brother was an organizer of the garment workers' union; and Driver Johann Carlson tipped back their chairs against the freshly sprinkled front of the building and heard their captain approvingly. They knew he would make a good battalion chief.

"I'm not sure of that one question," he was saying. "I often wonder what I'd do if that old trap did catch fire."

Five pairs of eyes picked out the tall, black silhouette of Schwart's beef house against the smoky evening sky line.

"Was I havin' my say," Hennessey replied, "I'd leave the

Engine 26 racketed into the street, its bell chattering, motor grumbling. Driver Carlson's wife was waving goodbye from the driveway. Pedestrians halted to watch the brief, glamorous passage of crimson steel

blasted shack burn. Them walls could fall a hundred feet."

"Aye," McSweeney agreed. "I'd have no close dealin's with it. I'd get off on top o' the box cars at the sidin', and siamese my lines two-and-two, and I'd hit her from there. Might be safe that far off. Ammonie . . . she's poor stuff when she gets to runnin' free and easy."

In the engine house the joker alarm set up an excited rattle. Jim Burton was on his feet before the polished instruments.

"That's us!" he said, and the crew leaped.

It was a roof fire, in a crowded tenement district, a dusty, smoky little blaze that hung on stubbornly. Captain Kellogg fought it without enthusiasm, subdued it at length, and returned silently to his quarters, still mulling over the questions of the day's examination.

The problems in hydraulics had been difficult. That had not surprised him. He had told the marshal that hydraulics bothered him. But that second one, for instance. He remembered it perfectly, even to the blurred carbon of the typewriter.

"Fire is discovered on the twenty-second floor of the Columbia building," it had begun, "two hundred and seventy-two feet above the street. You command battalion. Your first engine lays eight sections of two-and-a-half-inch hose. Hydrant pressure is ninety pounds. The pumper uses a hard suction. It is a new model thousand-gallon machine. You instruct your captain to hook on a half-inch tip. What is your nozzle pressure per square inch on the twenty-second floor?"

Captain Kellogg climbed dejectedly from the engine and set the crew to wiping down the wheels. It worried him, that one problem. He had figured the thing out twice since coming back from the board room, each time with a different result.

"AT LEAST old Dargan didn't get it," he assured himself savagely. "Probably missed all the hydraulics." But what consolation was there in that?

Twice and a third time that hot week he saw Acting Chief Dargan at insignificant fires. The old man had grown shorter, it seemed to Kellogg, squarer of build, harder jawed. He scowled as he worked.

On Saturday night Kellogg led his company into the front doors of a great oil-soaked garage. The wind was at his back . . . he always made sure of that; he had no liking for drafts puffing flame and smoke into his eyes.

Dargan rattled up in his own apparatus.

"Lead off!" he was screaming. "Joe, pull a two-bagger! A two-bagger, Joe! Four more pumps . . . what you doin', 26? In at it! Don't go blockin' the door!"

He led his own crew in past Kellogg's handful of men, and with spiteful vehemence attacked the flame. In ten minutes, even before the second alarm reinforcements had their hose laid, Acting Chief Dargan's battalion had beaten the fire.

"Get up close so's you can hit her next time," he counseled Captain Kellogg as the two companies were breaking their hose sections and rolling them into wet fifty-foot lengths. "That's what the fire business is for. Get in and knock it out!"

"Lots of gasoline," Kellogg answered sharply. "I got a good crew."

"Savin' 'em for pensions, mebbe," Dargan countered, and gave the younger officer his broad, square back.

Sunday passed without an alarm in the stockyards district, a gloomy day with spongy clouds and occasional sprinkles of rain. The fumes of rendering vats and the odor of cattle pens pressed down breathlessly upon the district.

Sunday night the air lightened. A fresh country wind drifted down from the north and Captain Kellogg went early to bed, leaving McSweeney on watch at the alarm stand. Hennessey and Jim Burton were playing checkers at the rear of the apparatus room. Stein had draped his meager body over the rough contours of hose on the box of the pumper, where he claimed it was cooler, and slept intermittently. Johann Carlson stood in the dark on the front driveway, talking in an undertone to his wife.

Kellogg, tired though he was, could not sleep. There was still the examination to plague him. The board had not yet opened the papers. But he was certain now that he had missed that second problem in hydraulics; missed it by twenty pounds. Forgot to allow for friction through eight sections of hose. Dargan might have stubbed his toes on that one too; very likely he had. But Dargan couldn't miss the others. That's where being a captain twenty-six years counted for something. Take that seventh question, for instance, about a fire in a china store.

"YOU are in with first company at a fire in a china store," it had said. "The blaze is small, in a basement stairway halfway back. The room is long, with a door on street and alley."

He'd answered that right, he was willing to swear. He had advised the spray tip on the hose nozzle. Heavy stream would smash the china. Smaller cities would have used chemicals in that situation. Big towns depend more on water, and in a china store, spray. So much for that. But then came the beef house. Dargan said he was wrong there. Dargan was a good practical fire fighter. Well, he still thought that if the situation ever arose, he'd go in from the north. He hated smoke in his face. . . .

He turned restlessly on his hot pillow. At the same moment he heard the steel teeth of the joker alarm bite out a message in the apparatus room below.

Five sharp notes . . . pause . . . five more . . . pause . . . a third five. In the code of the department, the instrument was shouting "Alarm of fire!" Kellogg sat up quickly, flinging back the sheet. Once more the joker was snapping. Three . . . two . . . two. Call for Ladder Truck 12. Truck 12's station was only half a mile across the district.

Sometimes Engine 26 followed Truck 12 on a joker alarm. Sometimes Engine 14 followed. Depended on location of the fire. Kellogg swung his feet over the edge of his cot. Like all firemen he wore his socks abed. His toes instinctively found their way into the tops of his bunkers, standing ready at the bedside. Even before the joker set up its next impatient call, Captain Kellogg's feet were pushing down the wide mouths of the rubber boots. He stood up sharply, listening, dragging the bunkers upward with his left hand, his right pushing his blue shirt down into them. He snapped the iron clasp at the waist.

"Two . . . six . . . ." the joker sputtered.

Kellogg wrapped an arm about the brass pole that thrust upward beside his bed through a hole in the floor. Ten seconds it had taken him to dress. He kicked away the canvas screen covering the hole and, hugging the pole with his right arm, shot down to the apparatus room.

(Continued on page 124)

The "horseless carriage" is exhibited for the first time. Drawn for "Whirling Wheels" by B. J. Rosenmeyer

Do you *Remember When* — *the Automobile was new and people shouted "Get a Horse!"?*

Those were the days that marked the beginning of one of the most thrilling and romantic struggles that America has known—the race of inventive geniuses to produce the marvelous machine that we now call the Automobile.

EDMUND M. LITTELL

EDMUND M. LITTELL

Author of "Midge" and "Fire-Shy"

has written the story of the Age of the Automobile in a masterful novel that has caught the full flavor and drama of this exciting period.

If you know the thrill of skimming over the highway, cradled in comfort behind a smooth humming motor, if you recognize the glamor of industrial progress, if you respond to the heroism of pioneers—men of vision who dared face poverty, discouragement and ridicule for an ideal—do not miss

"Whirling Wheels"

the remarkable serial which begins in our next issue.

It is a vigorous, sweeping story of the struggles and triumphs, loves and hates of real flesh-and-blood people. But more than that it traces accurately and with infinite detail the growth of the Automobile from an idea to the tremendous industry that we know today.

Popular Science MONTHLY

FOR AUGUST — *ON YOUR NEWSSTAND* JULY 2*nd*

An irresistible force rushing to the sea—the mad torrent of the Mississippi thundering through the gap in the Poydras levee, below New Orleans. This gap was made by dynamite blasts, to divert the flood and save the city

How *Floods* Challenge Science

Engineers Propose Gigantic New System of Levees in "Fight to Finish" to End Mississippi Disasters

By EDGAR C. WHEELER

DESTRUCTION, misery, death—and a gigantic challenge to the engineering genius of man! If there is one outstanding fact that has grown on the American people, watching the Mississippi River let loose its most devastating flood, it is this:

Science, achieving wonderful conquests of the air, the earth and the elements, has yet to leash the waters that rise in their might and break their bounds.

Helplessly, men see the flood rear its swollen crest. In futile desperation they fight back. By the thousands they swarm the levees, piling sandbags to reinforce the barriers. And yet the mighty waters surge on.

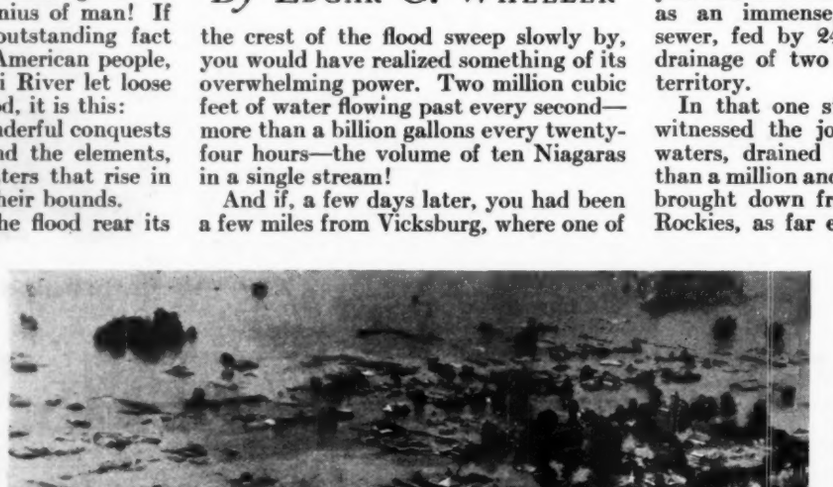
That is the Mississippi flood at its worst—$500,000,000 in damage perhaps. As this is written, there is a nation-wide demand for science to find a remedy.

Thirteen Mississippi floods in less than half a century! Everywhere Government officials, engineers and scientists are saying there must be no more. But what is to be done, and how?

If, one day late last April, you could have stood in Memphis, Tennessee, watching the crest of the flood sweep slowly by, you would have realized something of its overwhelming power. Two million cubic feet of water flowing past every second—more than a billion gallons every twenty-four hours—the volume of ten Niagaras in a single stream!

And if, a few days later, you had been a few miles from Vicksburg, where one of the strongest of the river levees gave way, you would have seen the Mississippi then as an immense, overburdened storm sewer, fed by 240 tributaries with the drainage of two thirds of the nation's territory.

In that one stream you would have witnessed the joining of many distant waters, drained from an area of more than a million and a quarter square miles, brought down from as far west as the Rockies, as far east as the Alleghanies, and as far north as the Canadian border! The Missouri from Montana and the Dakotas; the Platte from Wyoming and Nebraska; the Arkansas from Colorado, Kansas and Oklahoma; the Ohio from Pennsylvania; the Illinois from the region of Chicago; the Des Moines, Wabash, Tennessee, Cumberland—these and hundreds of other lesser rivers and streams you would have found mingled there in devastating flood tide. Small wonder that embankments of earth and sand should fail to bridle them all!



Typical scene of the havoc wrought by the Mississippi flood—an Arkansas city inundated after the water burst through a crevasse. Encampments of refugees are seen on the levee

YET experts believe that final mastery not only is possible, but practical. Plans are already under way for a scientific survey

of the flood regions. The chief of Army engineers, Maj. Gen. Edgar Jadwin, after a personal inspection, has predicted that the present Mississippi levees will be heightened at least five feet. Others have proposed rebuilding the entire 2,000-mile levee system, making it stronger, higher, and uniform in structure. At a cost representing one half the losses of the latest flood, we are told, the levees could be built strong enough to assure safety for all time.

BEFORE long we may see great walls of concrete rising to a height of fifty feet or more and extending for thousands of miles on both sides of the river and its important tributaries. It is not beyond the range of vision to foresee vast dredging operations that will deepen the river channels, make more room for flood waters, and open their far-reaching courses to navigation.

Then would the wide-flung network of rivers, now a menacing flood source, be converted into a great inland system of commercial waterways, with an outlet, perhaps, through the Illinois River into the Great Lakes; thence by way of the projected St. Lawrence waterway into the Atlantic Ocean. If the flood control legislation now planned is enacted, this will involve undertakings calling for the expenditure of hundreds of millions of dollars, directly affecting forty states. New sources of hydro-electric power will inevitably be created.

These are possibilities which eventually may grow out of tragic loss. For the present, the immediate concern is to safeguard life and property. In the knowledge of floods, their origin and progress, science has advanced far.

Today the coming of flood waters can be forecast weeks in advance, and inhabitants of threatened areas warned in ample time to seek safety. Assigned to definite sections along the important river systems are trained forecasters of the U. S. Weather Bureau. Each makes daily observations of rainfall, temperature and melting of snow. Considering these records in relation to the slope of the region and the condition of the soil, he is able to predict very accurately the approach of dangerously high water.

From records of previous floods, he knows the time it takes for high water to flow from tributaries into the main stream and for the flood crest to pass from one city to the next. Thus, for example, the time required for high waters to pass Pittsburgh, Pa., down the Ohio and Mississippi to New Orleans is twenty-two days. From Pittsburgh to Cincinnati, O., it takes five days; from Cincinnati to Cairo, Ill., six days; from Cairo to Vicksburg, Miss., seven days; and from Vicksburg to New Orleans, four days. The movement of flood water, of course, is slower than that of the river current. In the latest flood it was considerably slower than ordinary because of the extremely high waters.

The development of the Mississippi deluge may be traced in the numbers above. The first warning came in August, 1926, with rains in Kansas. The Mississippi and its tributaries drain two thirds of the United States, producing at flood crest the volume of ten Niagaras!

ADVANCE warnings of the Mississippi's greatest flood unquestionably saved hundreds of lives. Indeed, the first grim warning of the catastrophe came as long ago as August of last year, when heavy rains raised the waters of rivers in Kansas and Oklahoma. These were followed in October by damaging floods in the Arkansas and Neosho Rivers in the Kansas prairie region. Then the rains drifted eastward, over Missouri, Illinois, Ohio, Tennessee, Kentucky, and the Cumberland valley. Since all this water was at a season when rivers of the Mississippi system should normally have been at their lowest levels, official observers realized then that trouble was brewing.

"We knew then," says H. C. Frankenfield, head of the Weather Bureau division of rivers and floods, "that if the rains of the coming winter and spring were much above normal, we were going to have a big flood. But, of course, we could not predict the volume of the torrent."

His worst fears were realized. Late in December more rains swept Tennessee and Kentucky. The Cumberland and Tennessee rivers rose to flood stage. All high water records in the Cumberland were broken. In January the winter rains became more widespread, and the Ohio River flooded. By March every one of the Mississippi's tributaries was dangerously swollen. Melting snows in the north and in the mountains far to the west and east added to the rising waters.

As the deluge gathered, Uncle Sam's watchful observers sent daily reports and warnings down the line. Along the levees of the lower river engineers organized workers and materials to resist the advancing enemy. Sandbags and other reinforcements were held in readiness. At crucial points levees were strengthened. Inhabitants were forewarned.

Then, in April, the angry

(*Continued on page 111*)

"Make Mississippi a Vast Lake," Is Hoover's Solution

"IT IS essential that time and money be not wasted in the consideration of visionary measures of relief. The feasible means of guarding against future disasters in the lower Mississippi is the adequate widening and raising of the levees on the main river and its backwater tributaries, and the extensions of bank protection, with special treatment in special situations in the lower valley.

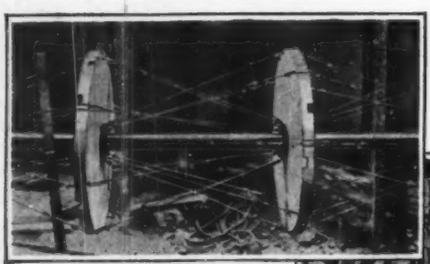
"The most practicable and economical reservoir is that which may be formed by high and strong levees in the most strategic location, the valley of the river itself, creating in effect a self-evacuating lake extending for 1,000 miles from Cairo to the Gulf."

HERBERT HOOVER
Secretary of Commerce

Loading the painting, in a huge crate, on the trailer that carried it to Havre

The Largest Package *Ever* Shipped

Removal, crating and transportation of five-ton war painting from France to America a triumph of mechanics



Spindles which were used, upended, to roll up the canvas

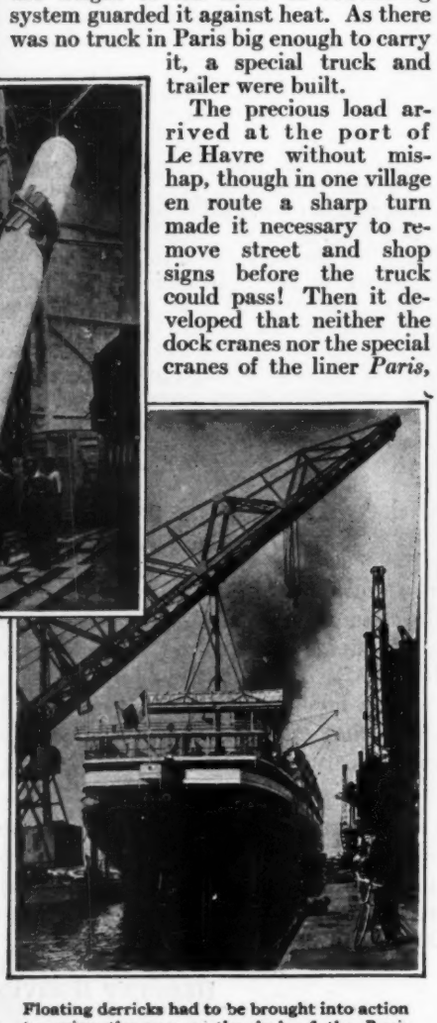
IN AN eventful trip from Paris, France, to this country, a five-ton painting recently taxed the ingenuity of mechanics and engineers charged with its transport—for it was said to be the largest package ever shipped to the United States!

The "Pantheon de la Guerre," or "memorial of the war," as the monster canvas is named, is a panorama history of the World War. It is four hundred feet long, fifty feet high and contains six thousand portraits. Until recently it occupied an entire building in Paris. When it was decided to bring it to America, unusual difficulties were met with and overcome.

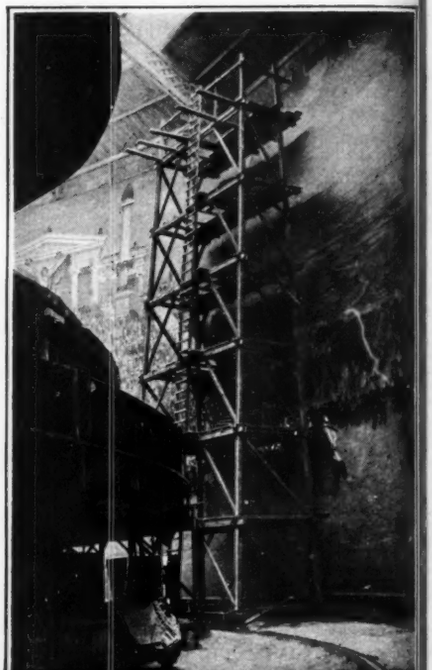
To remove the stupendous canvas from the wall without tearing, it was suspended like a shower curtain from sliding hooks on a metal bar. At one end a spindle the exact height of the painting was raised between concrete towers, and the canvas rolled up on it. Forty-five workmen were required for this job. Carefully the roll was lowered and crated in a packing case reinforced with iron rods and rainproofed with zinc, raising the weight to ten tons. A ventilating system guarded it against heat. As there was no truck in Paris big enough to carry it, a special truck and trailer were built.

Velvety cloth was fed into the roll to protect the canvas face from abrasion

The precious load arrived at the port of Le Havre without mishap, though in one village en route a sharp turn made it necessary to remove street and shop signs before the truck could pass! Then it developed that neither the dock cranes nor the special cranes of the liner *Paris*, on which it was to sail, could lift it! A huge floating crane finally swung it aboard, and it made the ocean trip above deck—there was no way of getting it into the hold.



Floating derricks had to be brought into action to swing the case on the deck of the *Paris*



Removing the painting from its Paris home: A runway had to be built around the top of the building to aid in rolling up the canvas

The painting will be exhibited in cities all over the United States. Its value is incalculable. Two French artists, Pierre Carrier-Belleuse and Auguste-Francois Gorguet, with eighteen helpers, worked on it every day during the war, recording each event as it occurred. When the Armistice was declared, it was complete.

Canned Food and Your Health

New Discoveries about Vitamins Science Has Used to Make Your Meals Good for You

By THOMAS M. JOHNSON

FOR fifty years, Grandma Jones has done her own cooking and "put up" fruit and vegetables every year. They were good enough for her and her family, but since she moved into a small city apartment to be near her married daughter, Grandma has had to eat "canned stuff."

"They taste good," she said, "but it seems like the old way must be best. There can't be any life left in the food."

So the family took Grandma Jones on a personally conducted tour through an up-to-date cannery. She saw and heard things about high grade canning methods that surprised her. She came away satisfied that her imagination—not actual conditions—had made her think unfavorably of canned food.

Almost at a glance, she saw automatic machinery in a spotless light-flooded room, handling tons of fresh peas with all the care she would have given a quart of them. She saw how orderly the process went on. Seven washings, endless inspection, constant supervision! In one line, peas issued from a washer through which ran a constant stream of fresh water. They passed on through a grader which sorted them into sizes—on through scalding water which left them bright, fresh and clean—over belts where deft fingers removed all that were not perfect—then to automatic filling machines, ready for the cans.

IN ANOTHER line she saw the bright, new empty cans, glistening in the light, emerge from a bath of boiling water and live steam. They moved to meet the freshly washed peas at the filling machines where just the right amount of hot juice was added to the peas in each can. The cans were quickly sealed by machinery, then moved to giant retorts or cookers, where live steam carried the cooking to exactly the proper stage.

"We pour in the hot juice before they are hermetically sealed, to reduce the oxygen to a minimum," the guide explained. "Then the heating in the retorts takes up the rest. The peas are cooked, as nearly as possible, without air."

"But how about these vitamins, young man?" Grandma Jones asked. "Do you mean to tell me heating those peas so long doesn't kill the value of the food?"

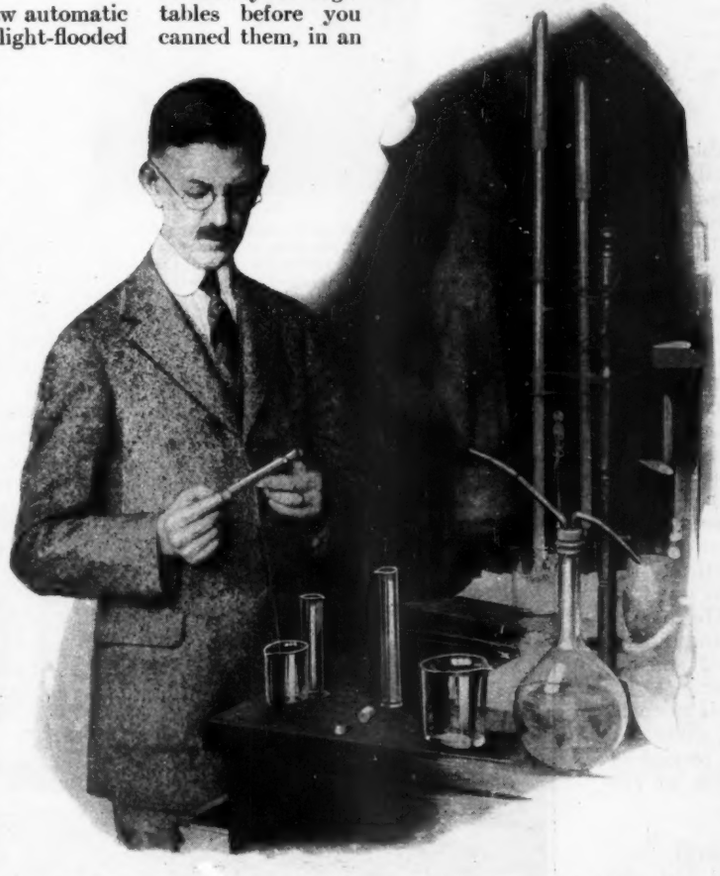
"We're sure it doesn't," replied the guide. "We've had scientists checking up on that very thing. When you used to cook your vegetables before you canned them, in an uncovered kettle over your kitchen range, you were killing vitamins. They can't stand being cooked in the presence of air. It's the oxidation you have to watch for, and that is what we avoid."

"What?" asked Grandma, incredulous. "Do you mean to say that canned foods are better for me than the things I cook over my own stove?"

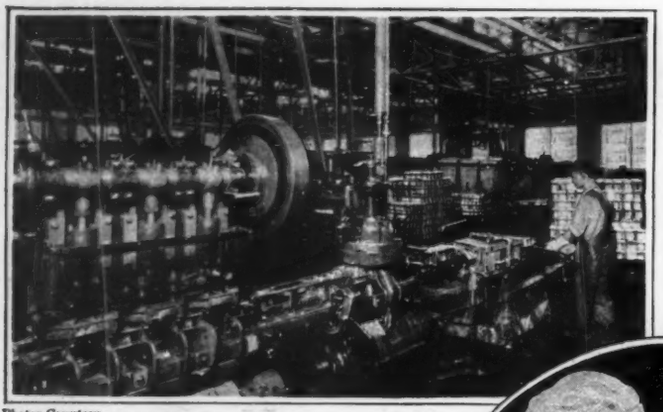
"WELL, there are more vitamins in many canned foods than in home prepared," the guide explained, "and food chemists believe a certain amount of vitamins are absolutely essential for growth and health. You must have fats, carbohydrates and protein, but the vitamin is the spark that sets off the energy they provide. Without the vitamin, the other elements are useless to the body. Except for this vitamin advantage in canned foods, there is really no difference between canned foods and fresh foods cooked in the home. Both are fresh to begin with—and both are cooked before they are eaten.

"Besides," the guide went on, "the fruits and vegetables used by canners are grown from specially selected varieties, that are usually better for canning than the ones shipped fresh. Added to that, there's no chance for deterioration between the time of picking and canning. Often 'fresh peas' have been on the market from two to four days before they reach your kitchen.

"We canners don't discourage home cooking," he continued, "but we do say that under our carefully supervised conditions, we produce as good food as you can prepare yourselves. Americans eat more canned foods than any other people on earth, and the more two-by-four kitchenettes there are, the more cans are opened throughout this broad land."



Prof. W. H. Eddy of Teachers College, Columbia University, the only scientist who claims to have seen the "chemical ghosts" called vitamins. Here in his laboratory he believes he has isolated the vitamin of yeast



Photos Courtesy California Packing Corporation

Left: In the modern canning plant sanitary sealing machines automatically cap and seal the cans hermetically at the rate of 80 to 120 cans a minute

Below: Delivered to the cannery, asparagus goes to the spotless sorting table where it is graded by hand according to color, quality and size

Filling cans with asparagus in an up-to-date canning establishment. Only a few hours elapse from the time the asparagus is cut in the fields until it reaches the canning tables. This assures fresh food to the consumers of canned goods

That fitted Grandma Jones's case exactly, so she sat down on a packing case full of cans of peas to listen while the young man told her more.

"Ever since canning was discovered through the offer of a prize by Napoleon Bonaparte more than a hundred years ago, people have thought the same thing you do, madam," he said. "They couldn't see how canned goods could compare with the home-cooked variety. But lately the canners have called in some of the ablest food chemists to help them. A lot of experiments have been made, mainly with white rats, and they have proved numerous facts about canned foods, particularly with reference to their vitamin content."

THEN he quoted what Dr. E. F. Kohman, research chemist of the National Canners' Association, has to say about vitamin C, the enemy of scurvy, which has been found most susceptible to heat and oxidation:

"'There is now considerable evidence that commercially canned foods are richer in vitamin C than the same foodstuffs home-cooked. Certain conditions in the sterilizing process that canned foods receive, and that do not obtain in home cooking, are actually beneficial in preserving this vitamin. Also, in the case of some products purchased raw on the market, the time which elapses between harvesting and cooking is considerably greater than that occurring in canned foods, and there is evidence that raw foods lose vitamin C in storage.

"'Cabbage canned and processed for thirty minutes at temperatures ranging from 212° to 260° F. had practically the same vitamin content, and this was four to five times as high as cabbage purchased raw on the market and home-cooked. Commercially canned spinach was also found richer in vitamin C by several times than home-cooked spinach, and there was no significant difference when the regular commercial process of seventy minutes was extended to 120 minutes.'"

GRANDMA JONES was slowly having her mind changed, but she wouldn't give up without a struggle.

"Now, young man," she objected, "I've read somewhere about these vitamins, that you can't see them with a microscope. How does a chemist know whether they're in canned food or home-cooked food, for that matter?"

"That's where the white rats come in," the young man replied. "Take a cage of them, and feed them a diet without any vitamin C. Feed those in another cage canned cabbage, and those in a third, home-cooked cabbage. The rats in the first cage will develop scurvy. The ones in the other cages will not develop scurvy. But it will take five times as much home-cooked cabbage to keep away symptoms of the disease as it does canned. The canned food has more vitamin C.

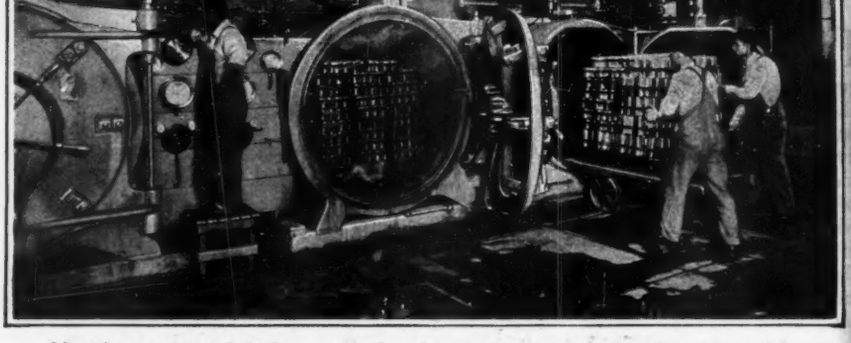
"NOW of course," he hastened to add, "it doesn't follow that people must eat canned food to prevent scurvy. Cooked food will do it, but not so well as canned cabbage, peas, spinach or cabbage slaw. We are always finding out something new about canned goods. Prof. Walter H. Eddy, of Teachers College, Columbia University, one of the foremost vitamin authorities, says that the 'raw food' fad can be overdone.

"Chemists are continually making investigations to improve our methods. Recently they found that by lining our wooden brine tanks with tin plates, we would reduce spoilage by bacteria. They are making important researches in this fascinating field of food chemistry. What are vitamins like? Is there a vitamin therapy? Can disease be cured by applying vitamins to diet? These are questions that are puzzling investigators.

"Dr. E. V. McCollum of Johns Hopkins University predicted recently that when we order dinner in the restaurant of the future we will order something like this: protein, eight ounces; carbohydrates, three ounces; fats, mineral and oils, one ounce; but all will be well garnished with 'vitamin sauce.' Even that highly scientific combination of concentrated food elements would be useless without the vitamin to act as the electric spark and make its energy of use to the body.

"The millennium of the food chemist, according to Dr. Eddy, will come when we know the exact food requirements of the human being of every age and occupation, and the exact contributions made to these requirements by available foodstuffs.

"It seems," the young man continued, "as if more and more depended on proper appli- (*Continued on page 112*)



After the cans are sealed, they pass to these huge cooking retorts, where live steam carries the cooking to exactly the proper stage, without destroying any of the beneficial vitamins

Stock Cars *Tested in* Real Races

Everyday Automobiles, Picked at Random from the Factories, Vie for Supremacy on Speedway

By JOSEPH S. EDGERTON

An eight-cylinder stock car hitting eighty miles an hour on a banked turn at the Culver City Speedway, Calif., during a recent two-hour test run. This car was partially stripped. All future tests will require complete equipment

A FASCINATING new spectacle, and one that gives promise of definite scientific value in the development of better motor cars, comes to America's speedways this summer. In place of highly specialized racing cars that only expert pilots can manage, we shall see everyday pleasure cars, picked at random from the stock of automobile factories, flash along the track in thrilling tests of speed and endurance. Well-groomed sedans and coupés, exactly like those which you and I drive through the streets, but with veteran racing drivers at the wheel, will be called upon to give their best in the stern competition of the track. At this writing an important series of racing events for actual stock cars has been arranged for the coming weeks under the supervision of a national contest board, and sanctioned by the American Automobile Association. By the time you read this article the first of these events—a seventy-five-mile Eastern stock car championship race scheduled for the Atlantic City Speedway—probably will have been run. On the incomplete entry list were various makes, including Studebaker, Essex, Paige, Chrysler, Stutz, Auburn and Whippet, while among their pilots were such old-time racing drivers as Harry Hartz, Fred Comer, Zeke Meyer, Gil Anderson, L. L. Corum, Tom Rooney and Wade Morton. Entries were limited to standard stock models of 300 cubic-inch engine displacement or less.

This initial event, for a stock car trophy and cash prizes, was expected to set the standard for subsequent races of the season—one at the Rockingham Speedway, Salem, N. H., scheduled for July 4; others at the Indianapolis Speedway and the Washington Baltimore Speedway at Laurel, Md. In addition, it has been announced that a $500 challenge trophy, to be contested for by strictly stock closed cars on the Indianapolis Speedway, has been offered by Samuel Stevens, banker and automobile enthusiast of Rome, N. Y. The Stevens Trophy will go to the first car establishing an average of sixty miles an hour for twenty-four hours.

So, for the first time in history, racing will give the auto owner a reliable measure of the merits of his car in competition with others he meets on the road, under absolutely fair conditions. Early in the history of automobile contests, so-called "stock car" races came into disrepute, for the reason that most of the entries were altered for the races into special speed machines.

In this year's events, we are assured, no alterations will be tolerated. The races are confined strictly to factory cars just as they are sold to the customer, without change of gear ratios, gasoline feed systems, ignition or timing equipment, or the stripping of the chassis in any particular. Indeed, automobile manufacturers who once shied at "stock car" races now are welcoming an absolutely fair test of their cars.

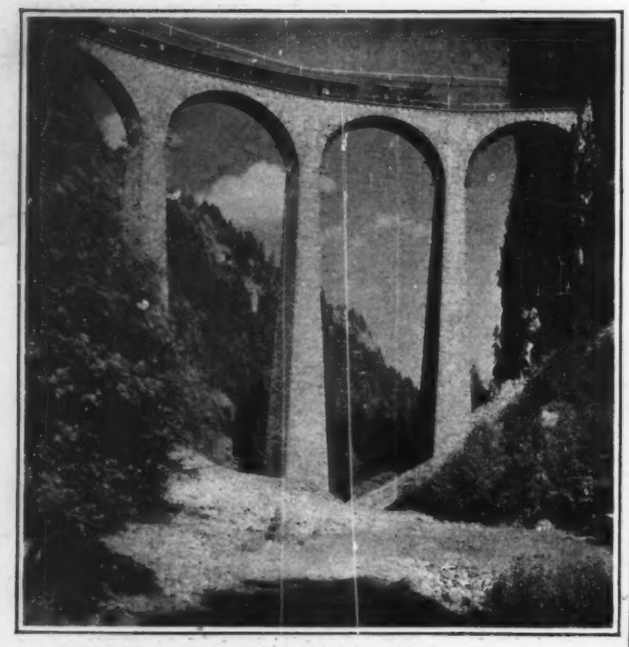
ASSURANCE of such fairness they find in the personnel of the national contest board, which includes such names as Capt. E. V. Rickenbacker, former racing driver and war ace; Tommy Milton, retired champion; Thomas J. Little, chief engineer of the Marmon Motor Company, and T. E. Myers, manager of the Indianapolis Speedway.

Moreover, the rigid rules of entry bar the chance of unfair advantage. The contest board exercises the right to pick every competing car at random from the manufacturer's stock, and to supervise it until the race. Each car must carry its complete equipment and accessories. The only allowable "tinkering" will be grinding valves, honing cylinders, relieving piston and bearing clearances, and adjusting moving parts.

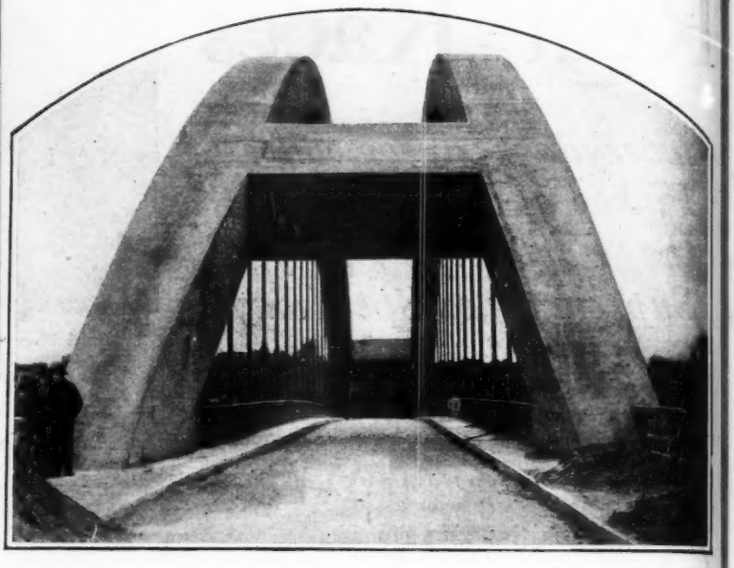
Experts declare that the contests not only will permit the public to check the claims of performance made by manufacturers and dealers, but will bring valuable improvements in automobile design. Gruelling racing conditions will reveal weaknesses in present fueling systems, steering mechanisms, cooling devices, brakes and motors, and also will stimulate engineering competition.

Above: A stock closed car of well-known make refueling at the pits during official speed test on the Culver City track. Left: The same car humming down the straightaway with Harry Hartz, famous championship racer, driving

A New Era of Huge Bridges



A veritable bridge on stilts is this lofty arched viaduct on the Rhaetian railroad, which traverses the Alps Mountains in Switzerland



Right: World's greatest cement bridge, spanning the Seine River at St. Pierre du Vauvray, France, 430 feet long and 114 feet high

TWO spans of startling magnitude, one on each coast, are soon to usher in the "new era of magnificently great bridges." After a generation of planning, definite steps are under way to bridge San Francisco's Golden Gate with a single span of 4,000 feet. On the east coast, construction will start this summer on a gigantic suspension span over the historic Hudson, from New York City to New Jersey. Its single span of 3500 feet will be double the greatest so far achieved—two thirds of a mile, or almost fourteen city blocks from tower to tower!

As this is written contracts are being arranged for the erection of the first of two 650-foot towers to support the Hudson River span. This will be on the New Jersey side of the river. At the same time, across the continent, a corps of noted engineers headed by Robert Ridgway, veteran New York subway builder, are working on the difficult problem of selecting the site for the California bridge, which will stretch from San Francisco across the bay to a point in Alameda County.

In these two gigantic projects the science of bridge building attains a scale which, only a few years ago, seemed beyond the range of the practical. They are possible today only because men of ingenuity and courage have overcome seemingly impassable obstacles with new inventions and materials.

For skill and daring the bridge builder is in a class by himself. From far below the equator to the frozen North, strands of cable are being spun over swift currents, and leaning towers of steel spring from widely separated banks to meet in mid-air. To these spinners of lofty steel webs, a single misstep often means a watery grave, with, perhaps, an iceberg for a monument.

Vision, for instance, a bleak June day on the Copper River in Alaska, a few years ago. Bridgemen are anchoring their caisson to the shore, when a thunderous roar echoes across the ice-choked channel. A monstrous berg detaches itself from the great Miles Glacier and plunges into the icy depths.

Now a wave of tidal proportions rolls toward them. In a few moments it has picked up the great steel cylinder like a plaything, and has flung it many yards away on the shallow bar. Not until days later can it be jacked back into its appointed place.

This was only an incident of that job, one of the daily and hourly assaults against supermen who dared to bridge a river of ice and icebergs. Deep snows, hundred-mile gales, rains and floods and bitter cold, freezing the river to a depth of nine feet, successively challenged their ingenuity. But a rich copper country was at stake. The tale of their bitter struggle for its opening is an epic of the North.

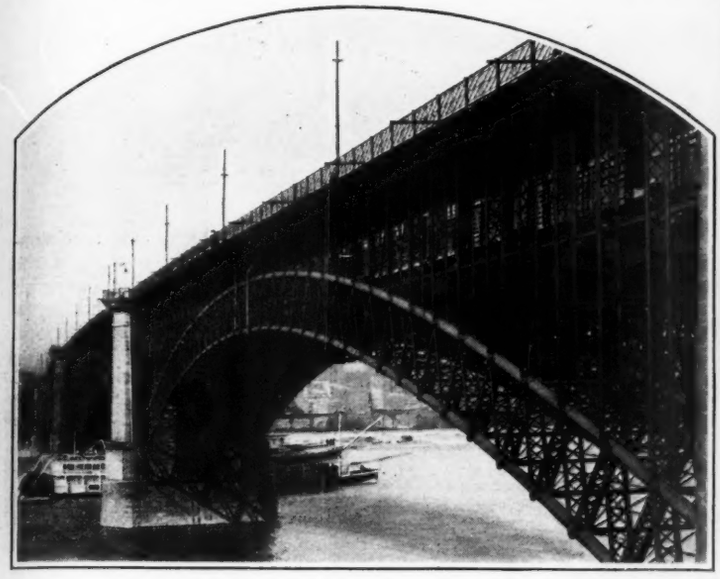
Borings and surveys were made with superhuman efforts. Thousands of miles away, the planning and fabricating were completed. Erection began on piers so carefully located that the largest bergs could not reach them. Floating ice tore away parts of the concrete forms as they were erected. A tower, supporting compressed air pipes, was built on a cofferdam resting on the river bed. Sensing danger, the bridgemen built a new tower on cables swung over the unfinished pier. A few minutes after the pipes had been moved, the old tower and cofferdam were lost in the rising water and ice!

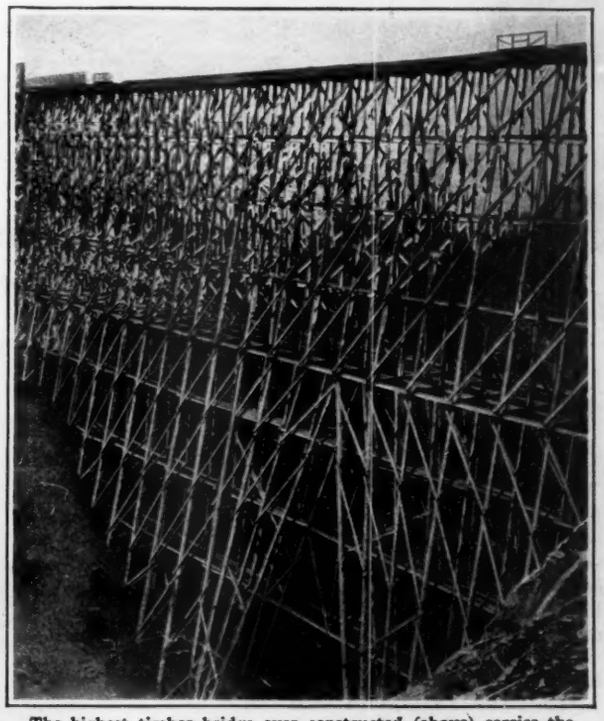
THE biting cold of the following winter caught them unexpectedly early, with a concrete pier yet to be poured. They built a housing around the pier and heated the interior. Concrete, water, sand and rock were heated to more than 100 degrees, mixed on shore, and carried overhead for a third of a mile in bitter cold, to be deposited at an average tem-

Zanesville, Ohio, boasts the only three-ended bridge in existence. This odd structure crosses the Muskingum River in the form of a Y, giving access to two separate points on one side of the river

How Engineers Plan and Dare to Build Mile-Long Spans of Steel

By ORVILLE H. KNEEN





The highest timber bridge ever constructed (above) carries the tracks of a logging railroad 893 feet across the Cedar River near Tacoma, Wash. It contains 836,000 feet of lumber. Of two-deck construction, it reaches a height of 204 feet. At the left is a remarkable example of modern steel arch construction—the $10,000,000 bridge over the Mississippi River at St. Louis, Mo.

perature of seventy degrees. The pier was perfectly molded, an unprecedented feat.

In the spring the ice renewed its drive on the falsework. The river rose, swollen by rains. For days and weeks, armed with steam jets and ice chisels, the bridge builders defended their position. Many times the falsework groaned. But in the end the bridgemen won. A ten-million pound web of steel today rises far above the charging ice floes, carrying long ore trains to and from the heart of the copper country. Year after year it is resisting the combined attacks of the Arctic.

I asked Dr. D. B. Steinman, one of the country's most resourceful bridge engineers, why it is that in scarcely half a century such stupendous bridges have become feasible, almost commonplace.

"We are just entering an era of bridge building which will far exceed the present achievements," he told me. "The motor car is the basic cause. It has brought the spirit of travel to millions, and they desire to move in reasonably straight lines. In the movement of goods, too, every mile saved opens up new fields of industry.

"UNTIL recently our great rivers and bays were considered insurmountable. Even when we learned how to bridge them safely, the cost of long spans seemed excessive. But today the building of a great bridge is simply a business enterprise. We determine in advance the best type of bridge and its cost. We compile traffic records and anticipate its growth. For the larger structures we establish small toll charges, more than enough to pay all operating costs. If the revenue will repay the entire cost within, say, twenty years, the project is a good investment. The community finally receives the bridge, which has been paid for by its users."

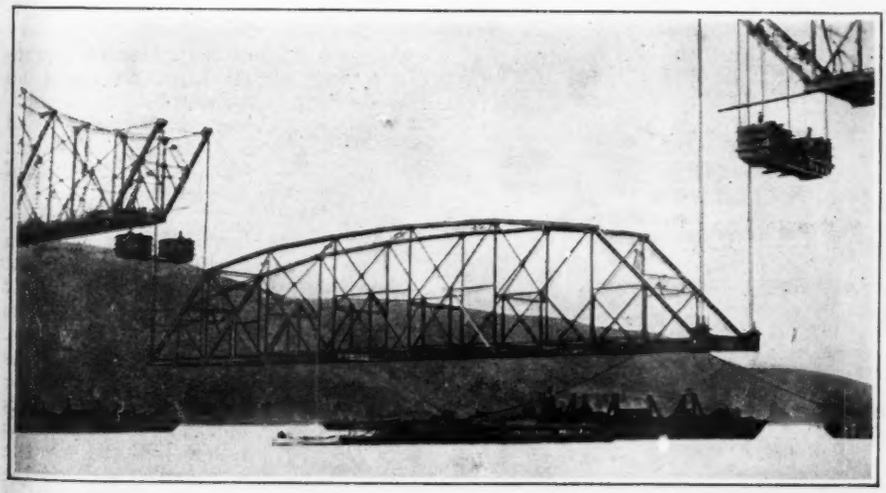
"But why," I asked, "are engineers so confident that much larger spans can be safely built?"

"Because we now understand the forces and materials with which we are dealing. We have new materials, of known strength, and capable of infinite variety. Moreover, we have evolved a science of design, and have invented new structural forms and combinations, such as the truss.

"You may be surprised to know," he went on, "that the suspension principle of the Brooklyn Bridge, with overhead cables to carry the load, was invented by primitive man. We have been unable to improve on this principle; the basic idea was perfect from the outset. Our apparent progress in this type, now enabling us to project single spans approaching a mile in length, has been largely in devising better materials, tools and labor-saving methods in erection.

"Primitive bridges invariably followed the suspension type, wherever native vines or plants permitted. In Peru explorers recently found a 148-foot span of fibrous roots flung by daring natives far above a deep river. Even longer spans, many prehistoric, have been found in India, China, Australia, Mexico and South America. Whole tribes have been known to cross mountain rivers on stout cables spun of vines or even animal hides, the ends securely anchored to trees or rocks, with a rough floor of logs lashed on. Perhaps an arrow carried the first string across.

"Such bridges, while light and shaky, will carry even pack animals. Twenty-five men at a time, for instance, can cross a 100-foot chasm (*Continued on page 128*)



An unparalleled engineering feat—How counterweight boxes filled with sand quickly lifted the 750-ton center span of the new bridge over Carquinez Straits, Calif., into its place 135 feet above the water

Couriers That Never Fail

Game to the Last, Thoroughbred Homing Pigeons Carry On When Even Radio and Airplanes Falter

By JACK O'DONNELL

DESPITE the amazing development of the telephone, the telegraph, the airplane and other means of rapid communication in the last quarter of a century, the humble homing pigeon still remains one of the surest, safest and most faithful messengers to which man turns in his hour of extremity.

When static interferes with the wireless, when wind or storm or sleet or snow level telephone and telegraph wires, when rivers or creeks overflow and wash out railroad bridges, when airplanes lose propellers; in short, when all other means of communication are at a standstill, the sturdy, courageous and intelligent little homing pigeon may be, and often is, called upon to bridge the gaps between isolated sections.

These feathered messengers, which were first imported to this country from Belgium back in the late 'sixties, have played important rôles in time of peace and in time of war, in sport and commerce, as messengers of mercy and—of Cupid. Their part in the World War forms one of the most glorious and romantic chapters of American history. When all other means of communication between men in the front line and their artillery support failed at Grand Pré, a little one-pound homing pigeon made its way through lead and smoke and gas to American headquarters, bearing the message that brought relief and saved the day for our forces.

It was a homing pigeon, all but mortally wounded, that came back from the Lost Battalion in the Argonne to General Headquarters with the message that gave the exact location and the condition of that ill-fated command.

Time and again these little fliers have been the only means of sending news of disasters, such as the Corpus Christi (Texas) flood of a few years ago, out of the stricken areas.

Is it any wonder that these birds have won the respect and admiration of men and women all over the world? Is it any wonder that there are more than 15,000 organized pigeoneers and perhaps 300,000 unorganized owners and racers of homing pigeons in the United States?

After a flight of 2,000 miles, this faithful homing pigeon was picked up, wet and exhausted, on a New York street. On one of its legs was a message telling that Dr. Edmund Heller, famous naturalist, was lost in the Hoodoo Mountains of Yellowstone National Park, Wyoming. The bird's courageous flight summoned a rescue party

While a vast majority of the thoroughbred homing pigeons in the United States are kept solely for racing purposes, others are used extensively by commercial concerns in the mountainous regions of the West and Northwest where thousands of villages, crossroad stores and farms are without regular mail or wire service. In those sections salesmen carry the feathered messengers in specially constructed boxes on the running boards of their automobiles and use them for emergency or rush orders.

One large flour company on the Pacific coast keeps a loft of 500 homers at its Western headquarters. Thousands of rush orders are brought to the main offices by these pigeons every month, much more promptly than they could be delivered through "regular channels."

THE best homing pigeons, when well trained, fly from five to seven hundred miles in a day without "dropping" for food or drink. The average commercial bird, however, will not average more than two or three hundred miles in a day.

While there is a wide difference of opinion as to how homing pigeons find their way home from distant points—some holding it is instinct that leads them; others that it is due to their telescopic eyes and prodigious memories—the weight of authority appears to support the latter school. Scientific tests have demonstrated that without its wonderful memory, its extraordinary powers of sight, observation and endurance a pigeon could no more find its way home from a distance of several hundred miles, unless it had first seen some of the intervening landmarks, than could an aviator, without mechanical instruments and maps, find his way from Canada to the Gulf of Mexico.

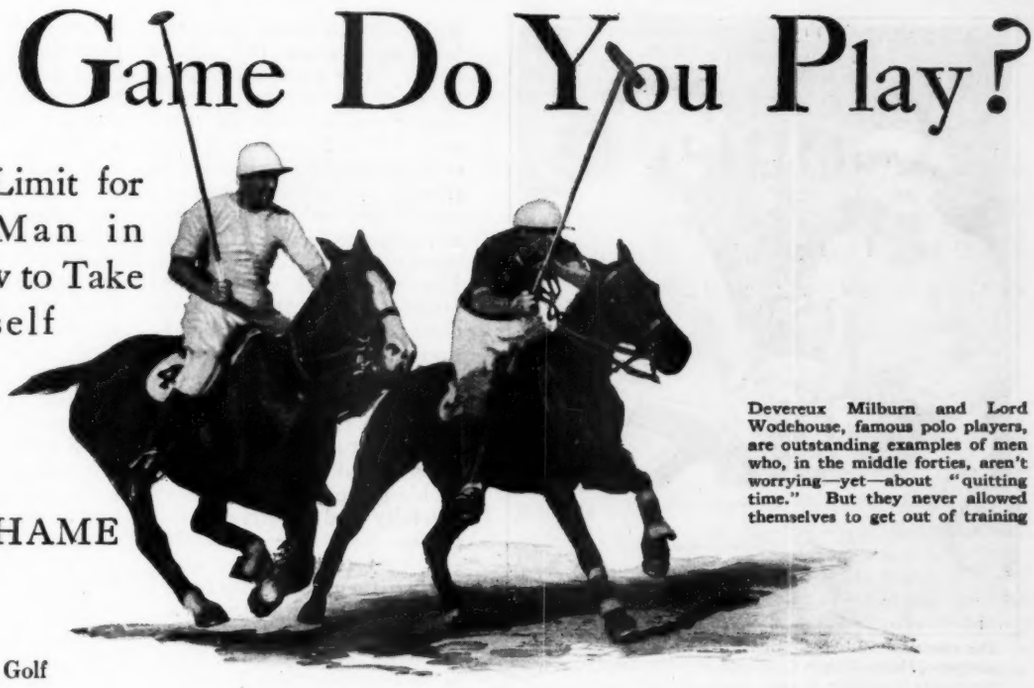
The start of a recent spectacular race between a thousand homing pigeons and an Army airplane, from Washington, D. C., to Baltimore, Maryland. The photograph shows the release of some of the pigeons near the Washington Monument

The training of homing pigeons is an art in itself. It requires great patience, a vast amount of time, and long hours of watching and waiting. This training begins when the squeaker, or baby pigeon, is six weeks old. The first thing it is taught is that the rattle of a can of grain is the call to meals. It is then taught to go quickly

(*Continued on page 112*)

What Game Do You Play?

There's an Age Limit for the Average Man in Every Sport—How to Take Stock of Yourself



Devereux Milburn and Lord Wodehouse, famous polo players, are outstanding examples of men who, in the middle forties, aren't worrying—yet—about "quitting time." But they never allowed themselves to get out of training

By
ARTHUR GRAHAME

"DROPS Dead on Golf Links."

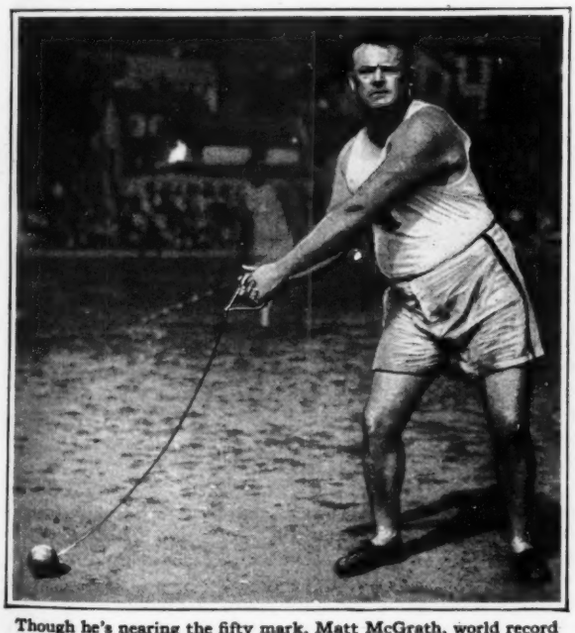
That headline appears in the newspapers much too frequently for the mental comfort of those of us who have stepped unwillingly out of the charmed circle of youth but still like to take our exercise at first hand.

"G. Henry Blank," we read, "53 years old, prominent in banking circles, died yesterday morning while playing golf on the course of the Clearfields Country Club. After making a good drive off the first tee, Mr. Blank complained of dizziness and shortness of breath. While waiting his turn to drive from the second tee he collapsed suddenly. Physicians said that death had been caused by heart disease."

Disturbing reading for the man approaching or past the forty-year mark, whose love of keen competition and a good sweat makes him unwilling to exchange the joys of active participation in sports for a seat in a baseball grandstand or behind the steering wheel of a motor car. More encouraging are the news items on the sporting page. Youth must be served, but often, he learns here, youth must wait modestly in the background while some veteran athlete gathers a few more honors.

Devereux Milburn, who is 46 years old and has been playing polo for thirty years, shares with Tommy Hitchcock, who is 27, the distinction of a ten-goal handicap, the highest rating of American polo. Clarence De Mar, close to the 40-year mark, continues to win grueling Marathon races. Walter Johnson, in his fortieth year and starting his twenty-first year of baseball, continues one of the greatest of pitchers.

Last October, Grover Cleveland Alexander, then in his fortieth year, saved the World Series for the Cardinals. Matt McGrath and Pat Ryan, both nearing fifty, hold their places among the great weight throwers of the world. John Ball, famous British golfer, won his first amateur championship in 1888, his last a quarter of a century later, and half a dozen of them between. Sandy Herd won the British professional golf championship at the age of 58. Arthur S. Lyon, who is 50 years old and weighs only 120 pounds, is the best saber fencer in America, and in the last two international matches against strong British teams won every one of his bouts.



Though he's nearing the fifty mark, Matt McGrath, world record weight thrower, still holds his own against younger competitors

These all are veteran athletes who continue to hold their own against much younger men. In some sports, notably golf and tennis, special provision has been made to provide competition against men of their own age for players who have reached the "veteran" stage. The annual championship tournament of the United States Seniors' Golf Association attracts three or four hundred golfers who compete in five age classes—55 to 59, 60 to 64, 65 to 69, 70 to 74, and over 75. Last year's championship was won by Frank A. Hoyt, of the Engineers' Country Club, who, competing in the 55 to 59-year class, shot 152 for thirty-six holes over a difficult course—a long way from the usual conception of "old man's golf." Even more remarkable was the performance of F. P. Abercrombie, of the Philadelphia Cricket Club, who had a winning score of 186 for thirty-six holes in the 75-year class. In tennis the national veterans' championship, open to players 45 years old or over, provides sport much higher in quality than that seen in most club tournaments open to men of all ages.

BUT such men form only a small detachment of the army of "over forty" players. Most of us, as we reach the middle years, are willing to play for the fun of the game and leave championships to others. The Earl of Balfour plays both tennis and golf at 79. John D. Rockefeller, now 85, enjoys his daily golf. The venerable Bishop of London, who visited us recently, engaged in a tennis match with Miss Helen Wills. John Allaire, vice president of the Amateur Fencers' League, who is 68 years old, fences for two hours four days a week. Secretary of War Dwight F. Davis, who gave tennis the Davis Cup and with Holcombe Ward held the national doubles championship almost thirty years ago, still plays tennis when he can find time—and plays a strong game, as does his old partner. And in almost any club devoted to sports you will find some "old-timer" who is able to make the best of the youngsters step lively to beat him.

Against all this stand those frequently read headlines, "Drops Dead on Golf Links."

Is there a definite quitting time in sport? If there is, when do we reach it?

The venerable Bishop of London put up a strong game as partner of Helen Wills in California recently. Regular practice makes it possible to play tennis, at least, indefinitely

I set out to learn the answers to those questions.

The first man I went to was Dr. Philip B. Hawk, well-known dietitian and food research expert, who held the national veterans' singles tennis championship from 1921 to 1923 and has been a strong contender for the title each year since then. And, by the way, veterans' tennis as played in the national veterans' championship is no game for decrepit old gentlemen—far, far from it. It's as hard and fast a game as any other variety of high-class tennis.

Doctor Hawk is 52 years old.

"When," I asked him, "should a man give up tennis?"

"That depends entirely on the man," said Dr. Hawk promptly. "If his heart is in good condition, he need never give it up. I've been playing for more than thirty years, and believe I put up as good a game today as I ever did.

"Of course," he went on, "as a man grows older he must take precautions that a youngster isn't likely to bother about. Every man over forty who takes part in any strenuous sport should go to his physician for a thorough physical examination before the opening of the season. I always do that. Heart troubles sometimes develop rapidly, and if there is anything wrong with me, I want to know it before I take any violent exercise. And the tennis player who has passed forty should work out very carefully in the early part of the season. He never should place a sudden strain on his heart—or on any other part of his body, for that matter.

"REMEMBER, though, that you can't draw general conclusions from one man's experience. I'm fortunate in being a descendant of strong, long-lived people, and that counts for a great deal. And I've never given up active play. That's a really dangerous thing to do. Many young men engage in strenuous sports in college, take no exercise for the first two or three years of their business careers, and then try to go back to sport. Naturally, in many cases the heart can't stand the sudden strain. The man who wants to continue his activity in sport through middle life never should allow himself to get out of condition. If he intends to play tennis in the summer, he should play indoor tennis during the winter, or take up some other game. Personally, I've found that bowling, supplemented by setting-up exercises, keeps me in good condition during the off-season.

"Sometimes, of course, circumstances make it necessary for a man to give up sport for a year or two. If he is organically sound, he can get back to his game by starting very carefully and slowly. A few games—not sets!—of the easiest kind of tennis is quite enough for a man who hasn't been playing for a year or so.

"Quitting time? For the normally healthy man, there is no quitting time in tennis. Sensible living the year round, the precaution of a physical check-up once a year, and careful practice in the spring, should make it possible for a man to play tennis indefinitely. I, for one, hope to stick to the game as long as I can carry a racket around the court!"

Next I went to Daniel Chase, former New York State director of physical education and chief of the New York State bureau of physical education. Mr. Chase is executive secretary of the Sportsmanship Brotherhood, an organization whose chief object is the teaching of the spirit of sportsmanship to the young people of this and other countries. He was for some years director of athletics at Hamilton College, and while at the head of New York State's physical education forces made a special study of sports and exercise for middle aged men and women. I told him about those "Drops Dead on Golf Links" headlines.

"Yes, I have seen them, too," said Mr. Chase. "And, of course, many people, of all ages, have asked me about this so-called 'golf suicide.'

"Now, we can't get away from the unpleasant fact that men do drop dead on golf links. Nor can we get away from the fact that men drop dead in other places. For example, many people are overtaken by heart failure while climbing the stairs on their way to bed. The difference is that when a man dies suddenly while playing a game it is news; if the same man were to die suddenly in his home, it would excite no comment.

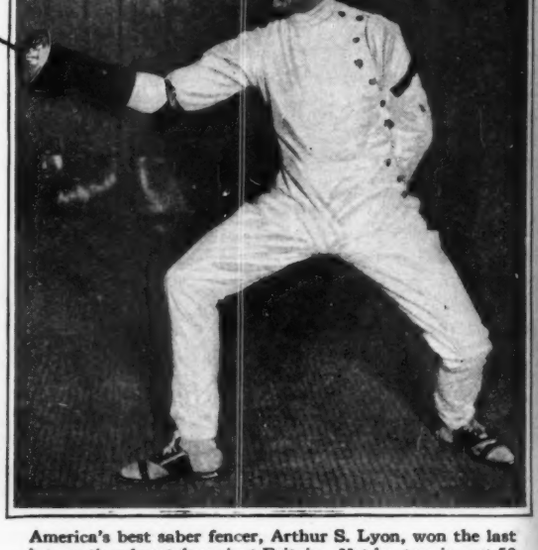
"But I do think there is a definite quitting time for the average man in almost every sport. Golf is an exception—the exertion it demands is not severe or sudden, and for a man who is in ordinary good health golf is a safe and beneficial game at almost any age. Swimming is another exception, exercising every muscle of the body without strain.

"Baseball is a fine game, but I'd draw the danger line at about forty—perhaps a few years earlier—except for the professional who plays day in and day out through the season. The 'business vs. professional men' games that are a feature of so many outings are bad medicine. I don't believe in baseball for men over thirty who do not use their bodies pretty steadily. It isn't good, for example, for mill operatives who sit down all day at their work. Playground ball, which is baseball played on a small diamond with a soft ball, gives the players the same fun and zest of competition without the danger of heart strain.

"THE danger line in track athletics for the average man must be drawn a little after thirty. One of the most dangerous sports in the world is the 'fat men's race,' another favorite at outings. Compared with it, polo, hockey and automobile racing are safe. The 250-pounder of thirty or forty who indulges in a fifty-yard burst of running is asking for trouble.

"In tennis it is more difficult to fix the danger line. It all depends on the player. The man who is able to play every day, or almost every day, and has been accustomed to doing it for years, can go on playing all his life.

"Provided a man keeps fairly steadily at his game, he can continue to take part even in strenuous sports until he is well into middle age. The whole secret is never to get altogether out of training, and never to place a sudden strain on the heart. If you haven't time to play enough tennis or baseball to make it safe for you, switch to golf. And remember that the most dangerous thing to do in sports is to give them up altogether. Every man should continue to play some game."



America's best saber fencer, Arthur S. Lyon, won the last international match against Britain. Yet he, too, is past 50

Broncho-Busters *of the* Air

By

CY CALDWELL

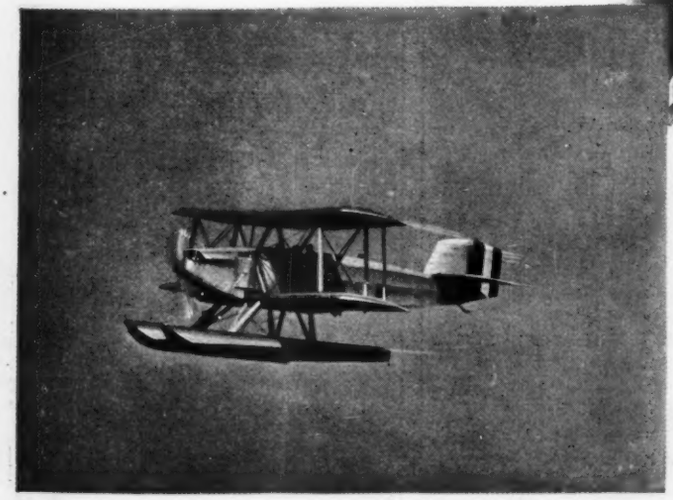
A test pilot tells experiences of the men who fly untried planes—How two of them set a record for nonstop flight

WHEN the two famous civilian test pilots, Clarence D. Chamberlin and Bert Acosta, recently drove the new Wright-Bellanca monoplane continuously for fifty-one hours, eleven minutes and twenty seconds, they did more than shatter the world's record for duration flight. They put their ship through the greatest and most severe test ever given to a flying machine. For two days and two nights and part of another day, while the plane hummed steadily in a circular course within a twenty-five mile radius of Roosevelt Field, Long Island, the two pilots took turns at the controls. Each, in turn, was able to snatch a bit of rest or a wink of sleep. But not once during those weary hours was respite given to the 200-horsepower air-cooled engine which drove them onward. Not once was a strut, brace, bolt or fabric relieved of the strain of flight.

Yet, when the last drop of the 385-gallon gasoline supply had been exhausted and the fliers glided to a safe landing, after traveling 400 miles farther than the distance from New York to Paris, mechanicians reported the machine in "as good shape as at the take-off!"

This world's record was a supreme triumph for two of the airmen whose almost daily job

Spectators greeting the Wright-Bellanca monoplane when it completed its record flight of fifty-one hours, eleven minutes and twenty seconds. At right: Clarence D. Chamberlin (in cockpit) and Bert Acosta, famous test pilots who took turns at the controls



The author photographed from the air while testing a new Navy bomber. "It's not so hazardous as you might think," he says, "for every part of the machine has been thoroughly tested before it goes up into the air"

it is to risk their necks putting airplanes of new design through their first paces. They are the bronchobusters of aviation. To their daring and skill is due much of the present progress in making heavier-than-air machines safe and reliable carriers.

Always, for example, before a new type of airplane is accepted for testing by the United States Army or Navy, and before a Government pilot is allowed to fly the machine, its safety must be demonstrated by the manufacturer. No matter what specifications may be written into the Government's contract with an airplane manufacturer, this one always is included: "The airplane shall be demonstrated by the contractor to be a reasonably safe flying machine."

And the man who does the demonstrating is the company's test pilot. He is the first man to leave the earth in this carefully-wrought materialization of an aeronautical engineer's dream—and sometimes engineers have bad dreams.

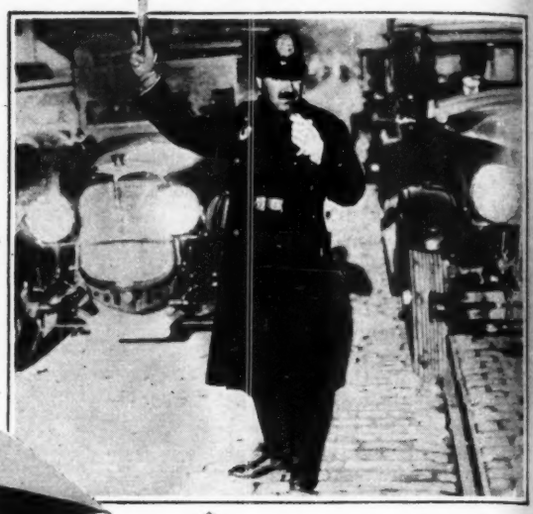
From the fact that he is the first man up in an untried plane—which might, conceivably, do anything with him—there has grown the idea that testing new airplanes must be extra-hazardous work. Actually, it is not.

Engineering knowledge and experiment have advanced so far that a capable engineer may estimate accurately not only the air stresses that materials to be used in the new plane must withstand, but also the high and low speeds, the rate of climb, and the altitude that the projected plane will attain—and that before a single part is made.

A plane is standing on a factory flying field awaiting its initial test flight. It is a large bomber and torpedo-carrier built for the U. S. Navy. As the parts were made, many specimens were broken to discover what strain they would bear. If the part proved unable to withstand a strain of from five to twelve times what it would have to withstand in flight, it was redesigned. The completed units have been subjected to loading to find what load each unit (*Continued on page 130*)

Traffic Cops *of Other* Lands

A military uniform distinguishes the traffic officer of Paris (left) —though Americans who find it all their lives are worth to cross a Parisian boulevard sigh for the military precision of New York's traffic system



Wherever a street intersection is, this genial cop of Belgrade, Serbia, is guarding it. White gloves help make his signals plainly visible

Sunny Honolulu, Hawaii, provides its cops with all the comforts of home—a comfortable seat and an umbrella as protection against the glaring sun

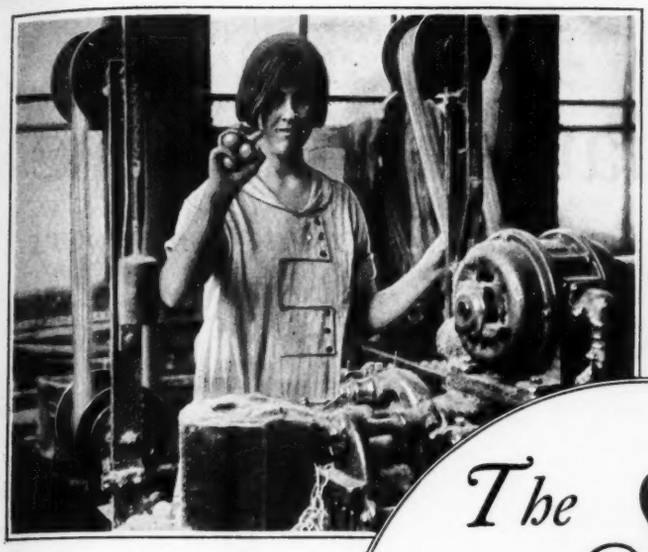
A raised club, a shrill whistle—these mean "Stop!" in Madrid, Spain. At least there's nothing ambiguous about this, even to the foreigner

Unique bull's-eye wristbands help make the hand signals of traffic policemen at Berlin's crowded street intersections conspicuous

In Oporto, Portugal, the traffic cops you meet on the most peaceful street corners carry diminutive revolvers and signal with clubs

The "bobbies" of London have capacious slickers—and wear them often. White sleeve bands make their signals visible through the dense fogs of the British capital

Traffic cops in Stockholm, Sweden, carry swords. They operate red and green lights which signal to drivers whether to go or stop



Each of the millions of baseballs used every year in American parks and sandlots starts in the factory as a little ball of cork and rubber

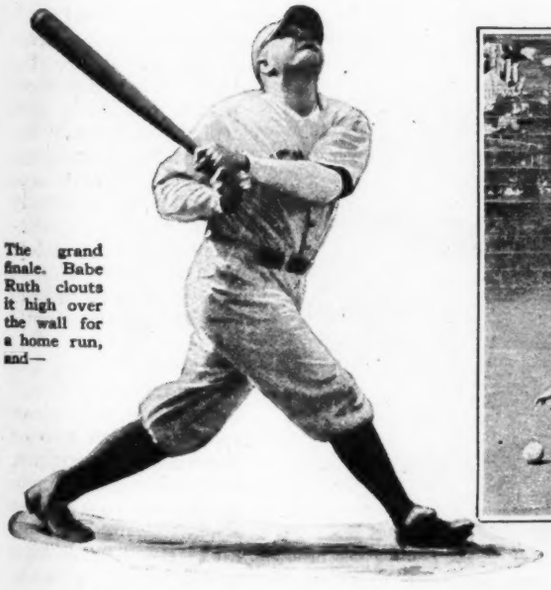
The cork-rubber core goes to a winding machine that wraps it with three layers of resilient woolen yarn

The Story of a Baseball

From a Bouncing Little Marble of Rubber to Fame over the Fence

Over the yarn is stretched the cover—two "figure eight" pieces of tough horsehide sewed together by hand; 216 stitches to each ball

The finished ball, weighing exactly five ounces, is a triumph of mechanical science and patience. Now it is ready to meet its fate in a ball park



The grand finale. Babe Ruth clouts it high over the wall for a home run, and—

—the kids on the other side of the fence scramble madly for the prize. So another of a big league club's yearly quota of about 7,000 baseballs passes into the unknown

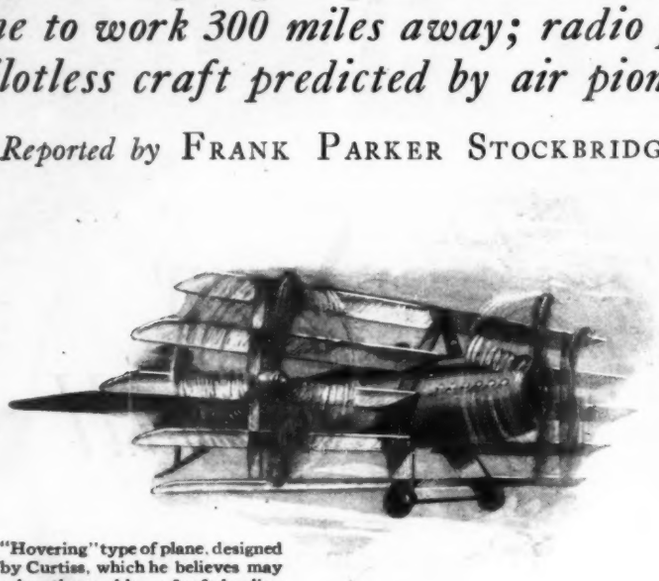
Glenn Curtiss Sees

A Vision *of* Aviation's Future

Motorcycle planes, weighing 40 pounds and carrying commuters from home to work 300 miles away; radio power and pilotless craft predicted by air pioneer

Reported by FRANK PARKER STOCKBRIDGE

LOOKING forward in the effort to visualize the future of aviation, some things seem crystal clear to me. But looking backward, over twenty-two years of aerial experimentation, beginning with my first association with Captain Tom Baldwin in building dirigibles, I recall so many dreams which failed to materialize that I hesitate to commit myself to definite predictions. Let what I have to say here, then, be taken merely as my present beliefs, rather than as definite prophecy.



"Hovering" type of plane, designed by Curtiss, which he believes may solve the problem of safe landing in the heart of cities. It can practically stand still in the air

That every city planned in the future will have a conveniently situated aviation field as an essential part of the plan goes without saying. Present cities not so equipped will have to provide such fields.

Flying from city to city, or from suburbs to the city and back, will be one of the most important developments of aviation in the near future. Aviation will greatly extend the suburban areas of our cities. Already many men of means are using flying boats for "commuting" between their waterside suburban homes and water-front cities. The first flying boat which I sold to a private customer was purchased by Harold F. McCormick, I think in 1914. Mr. McCormick used it for several years for his daily trip from his home at Lake Forest, Ill., to his office in the Harvester Building, landing and departing from the Chicago Yacht Club Basin in the heart of downtown Chicago.

THE flying commuter, however, must have something besides the flying boat. Just before the war we built what we called an autoplane, a sort of flying automobile, with an inclosed, streamlined body, mounted on four wheels which could be steered when on the ground. It had the engine in front and the propeller at the rear, and was designed to eliminate much of the risk of bad landing fields and forced landings. The war put a stop to our experiments. With the development of wireless transmission of power there will eventually be perfected a personal airplane so individual, so compact and so flexible that it will compare with airplanes as the motorcycle does with automobiles. This will be the type of aircraft chiefly used by commuters.

AS I see the flying motorcycle, it will be built entirely of duralumin or some other light alloy, with folding wings. The body will be just large enough for one man to sit in comfortably. Rollers, rather than wheels, will be the landing gear. It will have a wing-spread of about twelve feet, a lifting surface of, say, fifty square feet, and weigh around forty pounds. It will have a lifting capacity of about 200 pounds, leaving 160 pounds for motor and passenger.

This presupposes a much lighter motor than any now made. Great power will not be required, of course, for high speed will not be desirable. At the Curtiss plant on Long Island several of our young engineers experimented with small planes. Rivalry as to who could fly the smallest plane arose among them, and some remarkable results were obtained, using air-cooled motorcycle engines. No motor yet produced, however, is light enough for the commuting flyer's individual plane. What is needed is weightless, or practically weightless power.

I BELIEVE that will come. In view of what has been accomplished already in radio transmission of energy, I may not be peering very far into the future when I visualize a central source of energy, sending out waves to which the commuting flyer can tune-in his plane. His flying range will probably be short, but sufficient to get him to the city and back every day from a distance of perhaps fifty miles. That development only awaits the logical next step in radio engineering, and I have seen so many marvelous developments in that field that I believe this one, too, may come in my own lifetime.

For the long-distance commuter, traveling two or three hundred miles daily from home to office, the large multi-passenger plane, or flying bus, will be the main reliance. Such machines, dependable and economical, have already been built. Refinements in such matters as emergency control are well within the reach of present knowledge.

Curtiss built this autoplane for the "flying commuter" before the war. Today he predicts we'll fly to work in "flying motorcycles" having folding wings and rollers for wheels

The flying bus will also carry mail. It will be a multiple-plane machine, with two or three 500-h. p. engines, inclosed cabins, ample reserve power for storms or engine trouble. It will fly at high speed, up to a possible

150 miles an hour, and so designed as to be able to hover over one spot and practically stand still in the air. One of our own planes embodied this hovering principle. The five wings were rotatable on their longitudinal axes, like an ordinary window shutter, so that the back-draft from the three propellers, acting upon the wings, produced a lifting effect.

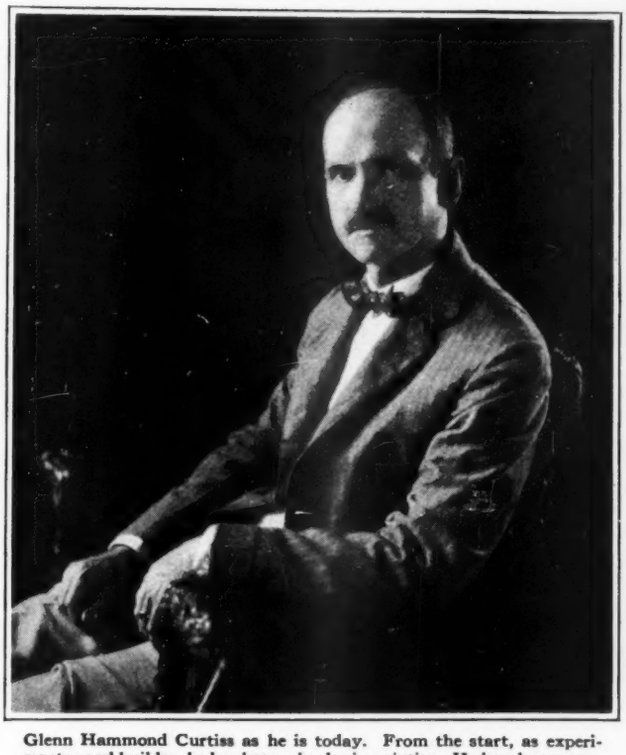
I believe this type of hovering device, rather than the helicopter, will help solve the problem of landing in or arising from a limited area. At Hammondsport, many years ago, we built what was, I believe, the first helicopter to rise from the ground. Contrary to popular impression, the helicopter requires a great deal of space for safety, because of its lack of lateral maneuverability. The dream often pictured by imaginative artists, of fleets of helicopters alighting upon or departing from the roofs of tall buildings, will always remain a dream, in my belief. I doubt whether it will ever be practical to utilize city roof tops for landing areas. Air currents produced by the presence of the buildings themselves will always make that dangerous. To roof over whole city blocks would shut off too much light and air. And so far as relief from street traffic congestion goes, a very few planes in the air at one time can produce a much more serious traffic congestion than the ordinary man imagines!

In the case of New York City, Governors Island offers an ideal landing field. A short subway tunnel would bring it within five minutes of downtown Manhattan. The aerial commuter will tie up his flying motorcycle or alight from his flying bus at some such point as that and be at his office or shop in half the time it now takes him by the fastest available means of travel.

ANOTHER popular dream which I do not expect to see realized in my time is that of the swift trans-Atlantic air liner, filled with passengers, flying from London to New York between dawn and dark. It can be done, but with our present knowledge it is both uneconomical and unsafe. A multi-passenger plane with a cruising radius of two or three hours in the air is easy to build. But to carry the same number of passengers on a continuous eighteen-hour flight would require an immensely larger and heavier machine, with more engines, and six or seven times as much fuel capacity. And to add further flight duration there would have to be conveniences for the comfort of passengers which can be eliminated in the short-radius plane. For every pound of useful load added to an airplane's capacity, considerably more than a pound must be added to the basic weight of the machine.

Anything approaching regular air passenger service across the ocean must wait upon great improvements in navigating instruments, both as to accuracy and reliability. Night flying and flying in fogs must be made safer than at present. It may take fifty years before such a regular service, with aircraft competent to surmount the hazards of storm, is established; and by that time the need for it may easily have passed. It took fifty years after the first steamship, the *Savannah*, crossed the Atlantic in 1815, before regular, scheduled sailings were possible.

At present the cost of trans-Atlantic flight, assuming that it were safe, would be prohibitive to all but a very few; and recent developments in radio and television have made many of the things unnecessary for which men of great wealth might pay for fast transport across the ocean. Today a perfectly private conversation can be carried on intelligibly from any part of the United States to England; signatures to checks and other documents have been transmitted overseas by radio and accepted by banks and courts; photographs are readily transmitted. All of that reduces the demand for speedier flight from continent to continent.



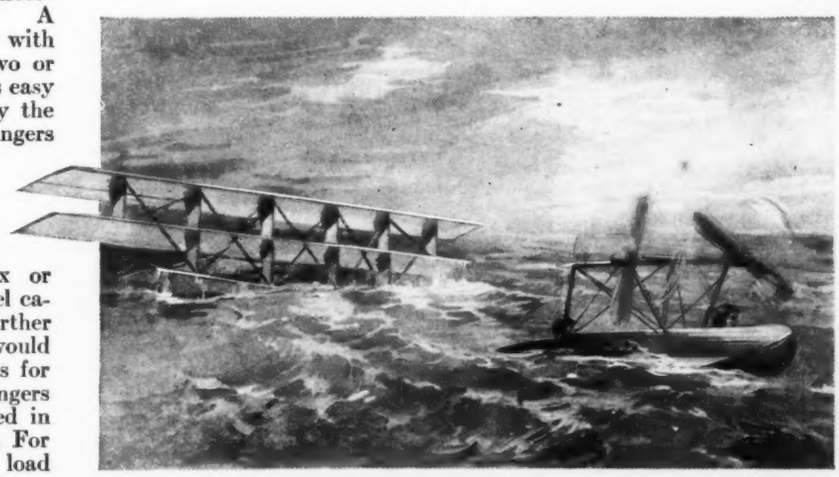
Glenn Hammond Curtiss as he is today. From the start, as experimenter and builder, he has been a leader in aviation. He has done more, probably, than any other to make flying easier, safer and more popular

In much less than fifty years, however, I expect there will be regular air mail routes established across the Atlantic. Carrying mail is a much simpler job than carrying passengers. Mail matter, moreover, represents almost the only class of commodities which can stand the freight toll of air transportation over long distances. Even silk, once the most precious of regular freights, no longer can pay such high transportation charges; rayon has cut into the silk market and reduced the demand.

The greatest developments of the next few years in aviation, aside from preparations for the next war, will be in the mail service and in passenger carrying between cities. In fact, the airplane is rapidly approaching the point where it will be the most economical means of transportation for men whose time is of value. As an example, the highway route between Miami, Florida, where I live, and Venice, on the opposite coast of Florida, where Mr. Stockbridge lives, is more than three hundred miles; the rail route is at least a hundred miles longer. Every time we have met to work on this series of articles for POPULAR SCIENCE MONTHLY, one or the other of us had to make an eight-hour motor trip or a twelve-hour railroad trip, spend a night away from home and take as much time going back. The air-line distance between our homes is two hundred miles—easily flown in an hour and a half. If adequate airplane passenger service had been available, the time saved us would have been far in excess of the additional cost of transportation.

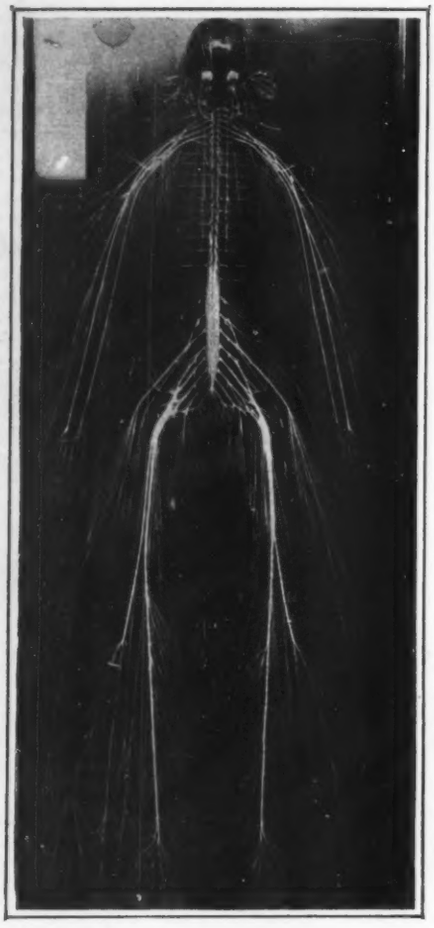
Before such passenger service can develop to its fullest possibilities, before the aerial mail service can realize its fullest usefulness, great advances in night flying must be made. The time will come when we will look upon the present system of marking mail routes by searchlights and locating landing fields by the same means as ridiculously crude. As with coast lighthouses, the time when lights are needed worst is when they can't be seen, by reason of fogs or storms. Up-to-date ships at sea are equipped with the

(*Continued on page 113*)



How the Curtiss "flying lifeboat," built during the war, cruised safely to land after shedding its wings. Flying boats will play an increasingly important role, Curtiss predicts

Latest Advances *in* Science



What the human nervous system actually is like is shown in this remarkably complete replica, the work of Dr. Rufus B. Weaver, noted anatomist, of Philadelphia. So valuable is the model regarded that it is locked in a vault of the Hahnemann Medical College, Philadelphia

On these pages are presented each month brief stories of scientific discovery and research having practical bearing on our everyday problems.

A New Electric Insulator

CHEAPER deliveries usually mean cheaper goods—whether the commodity be electricity or groceries.

A new insulating material for high voltage transmission lines now promises cheaper electric light, heat and power for homes, office buildings and factories. The invention comes from the laboratories of Russian scientists headed by Dr. Abram Joffe, director of the Physical-Technical Institute of Leningrad.

High pressure electric currents are always trying to jump out of the wires that carry them, either from wire to wire or to the ground. To prevent this "leakage" elaborate and costly methods have been required. Tall masts, for instance, are fitted with wide-spreading cross arms to hold the wires far apart, while the wires themselves are suspended from expensive porcelain insulators.

The Russian scientists say that a very thin layer of the new insulation—a comparatively cheap, varnishlike material—will resist the pressure of high voltage fully as well as will the heavy, expensive porcelain. In round figures, they have shown that a film of the stuff a third of an inch thick will resist the pressure of a hundred million volts!

If the new method proves practical, it may be possible to lay high tension lines in conduits and so do away with the present expensive pole construction.

Send Color Photos by Wire

COLOR pictures, in addition to black and white photographs, soon may be sent over long distance wires, officials of the American Telephone and Telegraph Company recently announced. The company is planning to add color reproducing mechanism to its present apparatus.

At present a person or business concern wishing to send a three-color picture by wire would have to send three separate photographs of the picture—one taken through a screen which filtered out all colors but red; another through a blue filter, and a third through a yellow one. The receiver would have to print the three different negatives successively in their respective colors on the same paper.

The proposal now is to install apparatus at the various telephoto stations to deliver finished color prints.

Ethylene As Fruit Ripener

ONCE again chemical research pays big dividends. This time it is in the discovery of a method, announced recently before the American Chemical Society, of saving American fruit growers millions of dollars a year by the use of ethylene gas.

Dr. R. B. Harvey, of the College of Agriculture in St. Paul, Minn., is the discoverer. He has found by experiment that this gas, used in cutting torches and as an anæsthetic, has the property of ripening fruit in an amazingly short time. Fruits which would require days or weeks to ripen on the trees now can be ripened, it seems, in a few hours. In addition, the gas averts danger of plant diseases.

Sweeter fruit may also be a result of the gas treatment, for it is said to increase the fruit's sugar content, reduce its acidity, and make it more palatable. Moreover, it is claimed, a fruit crop may be distributed over a period of weeks, instead of being dumped on the market all at once.

U. S. Sends Most Telegrams

AMERICANS send more telegrams than all the people of Europe. A third of all the telegraph wires in the world are in the United States. We have 2,220,002 miles of telegraph wires, compared with 2,662,740 miles in Europe and 6,549,556 in the world. Last year Americans sent more than 200,000,000 telegrams, or almost two messages for every man, woman and child!

If Samuel Finley Breese Morse were alive today to read these recently compiled figures, he would rub his eyes at the miracle of invention.

Smoke War On in New York

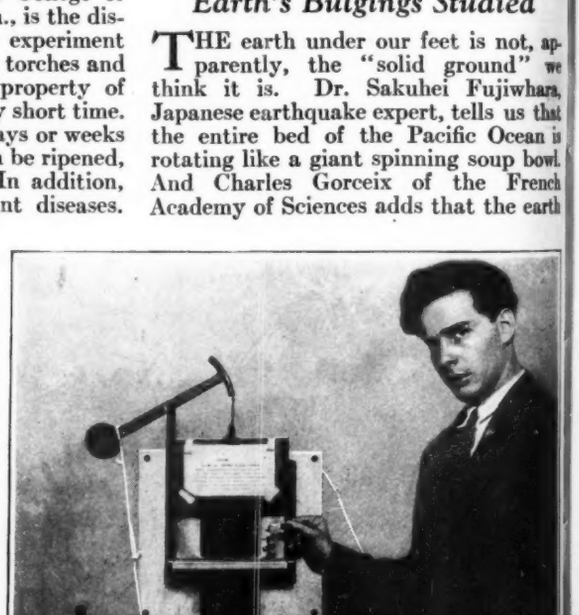
NEW YORK CITY has begun a scientific campaign to clear its air of smoke.

In the May issue of POPULAR SCIENCE MONTHLY, George Lee Dowd, Jr., revealed startling facts about the menace of smoke and dust in American cities. Shortly afterward, came the announcement that the New York health commission, coöperating with engineers, had undertaken a survey of the city's smoke conditions. Among other things, they will make a count of smoking stacks and will estimate the volume of smoke emitted by industrial plants.

Meanwhile, experts of the British Medical Research Council have estimated that London smoke shuts off at least sixty-five percent of the health-giving ultra-violet rays of sunlight. For the first time they have succeeded in demonstrating conclusively that one of the greatest injuries caused by smoke is the blanketing of these beneficial rays.

Earth's Bulgings Studied

THE earth under our feet is not, apparently, the "solid ground" we think it is. Dr. Sakuhei Fujiwhara, Japanese earthquake expert, tells us that the entire bed of the Pacific Ocean is rotating like a giant spinning soup bowl. And Charles Gorceix of the French Academy of Sciences adds that the earth



Permanent waving doesn't injure the hair, announce Bureau of Standards experts, after recent tests to find out how much heat various types of hair could stand without breaking. The photo shows C. R. Brown of the Bureau placing a strand of hair in the test oven, the door of which is opened by a weighted lever

Insulator Promises Cheaper Transmission of Power—Hair Waving Tested—Fruit Ripened by Gas—Other Discoveries

A tiny new microscope lamp is the latest aid to microscope users, developed in one of the great research laboratories. Attached under the plate, the lamp throws its light directly on the object being studied, eliminating shadows

probably is growing flatter at the poles and bulging out at the waist line. Still another scientist likens the bulging to that of an imperfect golf ball.

At least two scientific undertakings within the next few months will add much to knowledge of our globe. One, planned by the California Institute of Technology, will study land movements in southern California. Monuments will be set in a straight line across a suspected earthquake fault. If the monuments are twisted out of line in the next few years, it will be taken to indicate earthquake danger. The other expedition, undertaken by the U. S. Geological Survey, will explore scientifically the volcanic Aleutian Islands, southwest of Alaska, one of the quakiest spots on the face of the earth.

Rays Dry Up Paint Oils

WHEN, a few months ago, Dr. W. D. Coolidge of the General Electric Company first demonstrated his new cathode ray tube and its remarkable properties of working strong changes in substances placed in the path of its rays, everyone asked: Of what use is it?

Today, at least one practical use has been found. Prof. J. S. Long of Lehigh University has revealed that cathode rays from the Coolidge tube will dry paint in amazingly short time. Exposing glass plates coated with linseed and other paint oils to the bombardment of electrons, he found that the plates dried in only two or three hours.

Broadcasting from Balloons

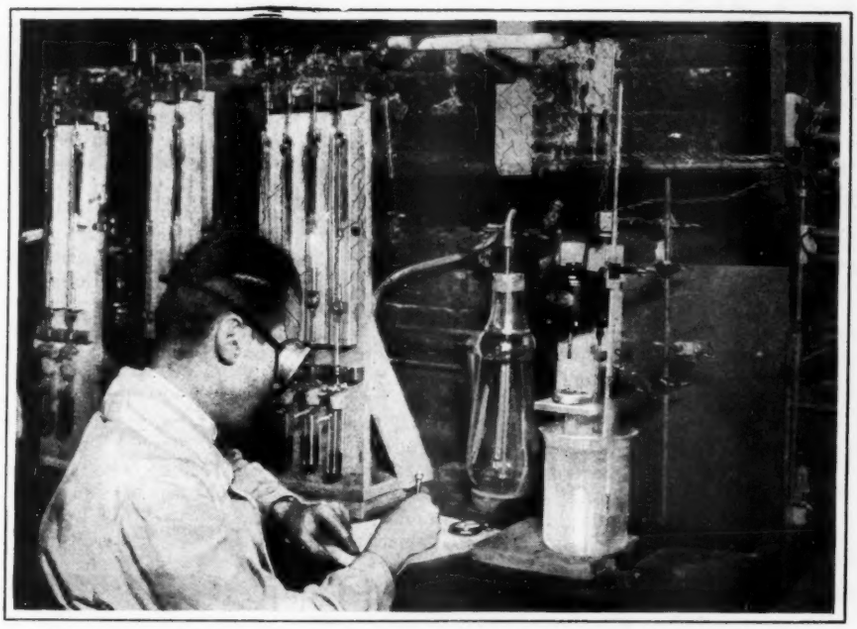
TO STUDY how radio waves pass through the upper levels of the atmosphere, two French engineers, Capt. Reginald Bureau and P. Idrac, recently sent up tiny floating broadcasting stations equipped with vacuum tube transmitters in place of the usual balloon baskets. Automatic devices sent out a succession of signals as the balloon progressed upward, while radio engineers throughout France and Switzerland noted the variations in reception.

While results of the novel experiment have not yet been announced, they are expected to reveal new facts which will be of value in the development of long distance transmission of radio waves.

In this connection the German physicist, Prof. Werner Kolhorster, recently advanced the opinion that the mysterious cosmic, or Millikan, rays, which are believed to be stronger fifty or 100 miles up in the atmosphere, may interfere with long distance radio waves.

Wealth Wasted in Lightning

EVERY lightning flash you see represents enough wasted electricity to light your home for forty years and more. One flash, on the average, represents about 30,000 kilowatt hours of electric power, worth more than $2,000 at prevailing American prices.



Lighting engineers hope to discover new secrets of "cold light" from phosphorus, which they are studying at the General Electric Laboratories, Nela Park, O., with the remarkable apparatus above

Throughout the world something like 2,000 thunderstorms are going on all the time. In their lightning flashes, the earth is continually wasting more than four billion horsepower—nearly a thousand times more than all the electric power now generated in the world.

These figures have just been announced by Prof. C. T. R. Wilson of Cambridge University, England.

Cat Has Nerves Extracted

A FEW weeks ago Dr. W. B. Cannon, of Harvard University, performed a delicate operation on a cat and removed part of its nervous system. The cat, recovering, had the unusual experience of gazing upon its own nerves mounted on a card! It also made important contributions to scientific knowledge about nervous disorders, certain kinds of indigestion, high blood pressure, and other human ailments.

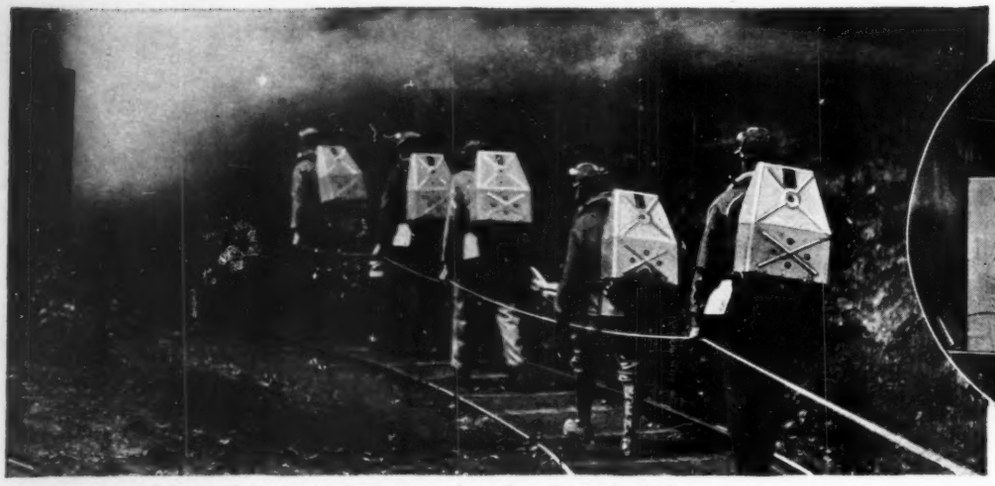
The part of the nervous system which the cat lost was the "sympathetic" system controlling the animal's ability to bristle its hair and to govern its body temperature. In the human body these nerves are believed to govern blood pressure and the bodily effects of emotions.

Other recent progress in medicine includes an iodine treatment for American sleeping sickness, developed by Dr. Frederic J. Farnell, of Providence, R. I.; a new drug containing mercury derivative and chaulmoogra oil for treatment of leprosy; the use of the spectroscope in the treatment of cancer for analyzing cancerous tissue; a serum treatment for peritonitis; and the beginning of research by the School of Dentistry, Temple University, Philadelphia, to find a cure for pyorrhea.

How Do You Sleep?

THAT love and financial worries are two violent disturbers of sleep has now been demonstrated scientifically by Dr. H. M. Johnson in tests of eighteen university students at the Mellon Institute, Pittsburgh. Among other things, the tests upset the belief that a normally healthy person "sleeps like a log."

In the experiments the volunteer students slept on special beds which recorded every movement they made during their slumbers. The results showed that the average straightaway period of rest during eight hours of sleep was only fourteen minutes. Each student "turned over" and changed his position on the average thirty-five times a night.



After the coal dust explosion, trained rescue men plunge into the smoke-filled experimental mine to test oxygen equipment and other rescue apparatus

Sampling air in a mine tunnel especially constructed to solve problems of ventilating the new vehicular tunnel beneath the Hudson River

Uncle Sam's Toy Coal Mine

How Scientists Play with Fire and Gas beneath the Earth

By M. E. CLEMENTS

FROM the black mouth of a coal mine, gaping in the side of a ravine, suddenly belches a terrifying mass of flame, with choking clouds of smoke and gas. A dust explosion—the thing most feared by coal miners—has swept through the workings with annihilating speed.

Trained rescue men, wearing grotesque masks and oxygen equipment, plunge into the hole and grope through the murk.

But in that mine, strange to say, are no men to be rescued. The only workers there to tell of the blast are marvelous instruments of science. For this coal mine is like no other in the world. It has no production nor profits. Operated by the U. S. Bureau of Mines near Bruceton, Pa., a few miles out of Pittsburgh, its sole output is new knowledge gained by remarkable experiments to make coal mining more efficient and less hazardous. Here engineers and chemists experiment to their heart's content. Deliberately they fill the mine with coal dust and explode it to learn of its hazards. They fill the workings with poisonous gas, then enter to observe the effects. At other times they test the safety of mining methods and machines.

To study the effects of made-to-order explosions, observation stations lined with concrete have been established at intervals of 100 feet throughout the mine. In each of these are placed delicate instruments which record the force of an explosion and the speed with which it spreads. One instrument, for example, uses a ray of light to record on a photographic film variations in pressure produced by a blast. Another device causes a break in an electric circuit when the flame of an explosion passes, the break being recorded by the pen of a timing instrument connected in the circuit. These records trace the progress of an explosion from one observation station to the next.

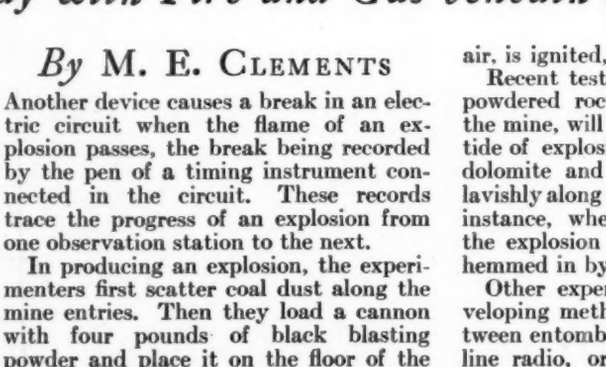
In producing an explosion, the experimenters first scatter coal dust along the mine entries. Then they load a cannon with four pounds of black blasting powder and place it on the floor of the main entry, pointing outward. An electric switch at the surface fires the cannon. From the muzzle shoots a flame twenty feet long. The coal dust, flung into the air, is ignited, and the explosion begins.

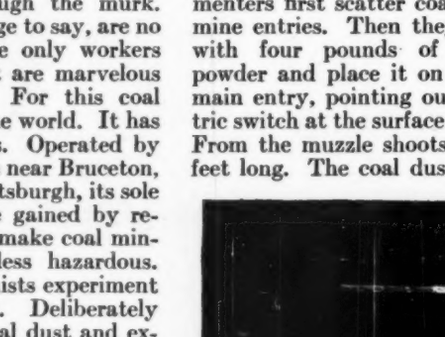
Recent tests demonstrated that finely powdered rock dust, scattered through the mine, will act as a screen to stem the tide of explosion. Powdered limestone, dolomite and shale, in turn, were strewn lavishly along the mine passages. In every instance, when the cannon was fired, the explosion was checked immediately, hemmed in by a curtain of rock dust.

Other experiments have aided in developing methods of communication between entombed miners and rescuers. By line radio, or "wired wireless," voices have been transmitted from 400 feet below the surface. With the geophone, a war-time instrument for detecting tunneling operations of the enemy, sledge hammer blows in the workings have been heard 650 feet away. And by a method of ground telegraphy, Morse code has been sent through 800 feet of solid rock into the depths of the mine.

Improved rescue apparatus likewise has been developed through knowledge gained by sending trained rescue men into the mine immediately after an explosion.

Aside from mine safety, the Bruceton experimenters recently have studied the problem of ventilating long vehicular tunnels, such as the new tube under the Hudson River, and of removing the deadly carbon monoxide gas of automobile exhausts. To measure accurately the contamination caused by auto engines, they actually constructed a test tunnel 130 feet underground and 1000 feet from the mouth of the mine. Through it autos were run while instruments recorded conditions of the atmosphere.





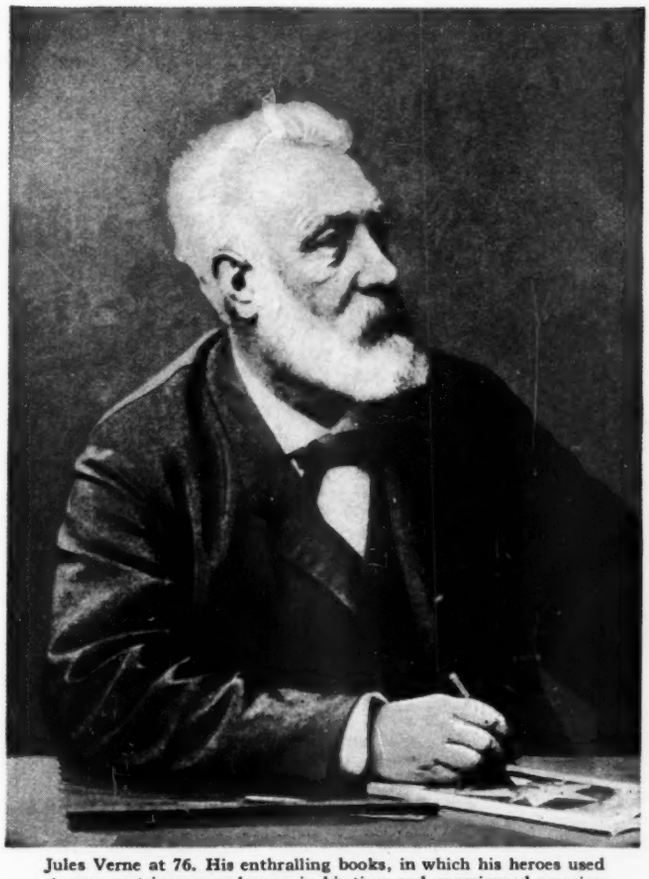
Above: Conducting ventilation tests with ingenious apparatus in the depths of Uncle Sam's experimental mine

Left: The geophone, developed for communication between entombed miners and rescuers

His Strange World *Came* True

How Some Amazing Prophecies of Jules Verne, Laughed At in His Time, Have Been Realized in Today's Mechanical and Electrical Marvels

By DON KNOWLTON



Jules Verne at 76. His enthralling books, in which his heroes used strange contrivances unknown in his time and experienced amazing adventures, have in many instances proven truly prophetic. Will future inventive genius realize still more of his fantastic predictions?

DID you know that a Frenchman, born in 1828, not only foretold, but described with amazing accuracy, several of the most outstanding of the mechanical inventions of the twentieth century—inventions which have changed the course of history?

This man was Jules Verne. In his day he was famous (as he still is) as an author, for he put his forecasts of future inventions into the form of adventure stories of startling interest. Many a boy has sat up all night thrilling to the hair-breadth escapes of one of Verne's heroes. His centenary will be observed next year the world over.

But in the days when Jules Verne was writing his stories, nobody thought of taking his mechanical prophecies seriously; for he wrote of ships that flew through the air, of boats that traveled hundreds of miles under the sea, of strange vehicles that bounded along the road at an unbelievable speed, without horses to pull them.

Of course these things do not seem strange to us, today. But Jules Verne wrote of them in days when people burned oil lamps, drove horses, and wondered whether railroad trains were safe to ride on!

ANOTHER reason why Verne's prophecies of mechanical invention seemed mere fancies to his contemporaries, was the fact that many of his books were out-and-out nightmares of adventure, which nobody—not even the author—could be expected to take seriously.

For instance, in "A Journey to the Center of the Earth," he tells how a German professor, his nephew and a guide descended several hundred miles into the earth through the crater of an extinct Iceland volcano. There they found an immense sea, upon which they sailed for days; witnessed a fight between a sea serpent and a great sea lizard, each forty feet long, monsters which still survived from prehistoric days; and finally, through a series of weird accidents, were spouted up on the crest of a column of boiling water and lava, until they shot out of Mt. Etna, as part of a volcanic eruption!

In another yarn, Verne describes a trip from the earth to the moon. A giant gun, 900 feet long, was buried in the ground in Florida. The charge was 400,000 pounds of guncotton. Its bullet was a hollow conical projectile of aluminum, in which rode three hardy adventurers, two dogs, and half a dozen chickens! The gun was shot at the moon, but *en route* the projectile was swerved from its course by the attraction of a meteorite. As a result, it rode, not to the moon, but around it, returning to the earth and falling, red-hot, into the Pacific! Its passengers, still alive, were rescued, and became the heroes of the day!

In another story, "Steam House," Verne tells of a steam engine built in the shape of an elephant and drawing two trailers, which traversed the wilder parts of India. The passengers became embroiled in a feud of vengeance resulting from the Sepoy revolt. In this, Verne was merely playing with science.

THEREFORE, when, interspersed with these lurid phantasies, Verne produced books containing serious scientific prophecy, his enthralled readers attached no more serious credence to the latter than to the former. In "20,000 Leagues under the Seas"—one of the most famous stories in all adventure literature—he put his characters on board a submarine which was practically identical with our submarines of today. Yet people of his own time considered the submarine merely another Verne phantasy.

Verne himself, though, took many of his prophecies seriously, as is amply evidenced by a cablegram which he sent to a New York newspaper in 1898 on the occasion of the thousand-mile voyage of Simon Lake's submarine. The cable began, "While my book, 'Twenty Thousand Leagues under the Seas,' is entirely a work of the imagination, my conviction is that all I said in it will come to pass." He pointed to Lake's vessel as direct evidence of this.

It is fascinating, today, to look back at his predictions and to see how many of them have come true; to marvel at the shrewdest of them and to laugh at some which now seem to us absurd. In the main, Verne was right. People do fly through the air, pilot boats under the sea, and ride in horseless carriages. Eminent scientists even plan seriously to shoot a rocket to the moon. But the

methods by which these things are done are, in many instances, quite different from anything Verne imagined.

Verne's submarine proved the most accurate of his prophecies. The submarine of today possesses a remarkably similar construction. It delves into the depths of the ocean, it acquires great speed, and it covers long distances without rising to the surface—just as did Verne's. Furthermore, the feats of Verne's adventurers, who, by the aid of diving apparatus, oxygen suppliers, and electric lights, left his submarine, the *Nautilus*, and went walking on the bottom of the sea, have since been duplicated.

THE mistake which Verne made in regard to his submarine (a mistake which he also made in connection with his aircraft, as shown later) was in the choice of motive power. His submarine was propelled entirely by electricity. Electricity-producing substances were mined beneath the waves, the electricity was stored in vast batteries of untold strength, and away went the *Nautilus*, even to the South Pole! And yet, Verne was not so far wrong. How could he, in his time, have guessed the amazing motive power of petroleum? Besides, as far as navigation beneath the sea is concerned, Verne was right—it *is* electricity which propels our present-day submarines, once they sink beneath the surface. Their Diesel engines charge their storage batteries for this purpose. So Verne's error was merely one of ways and means. Instead of underwater minerals, we use subterranean oil.

Among the most fascinating of Verne's conceptions are his dream-flights in the air. The conquest of the sky had for him a tremendous fascination. Away back in 1863—during our Civil War—Verne wrote the first of his more famous stories of the air—"Five Weeks in a Balloon." In this yarn, he takes three adventurers across Africa in a balloon which can, if desired, remain in the air for days at a time, ascending or descending as the pilot wills.

THE idea of the balloon itself was not, of course, new, for balloon flights of considerable length had been made before 1863. But Verne undertook to show in this story that devices would be invented to enable balloons to remain in the air for long periods and cover immense distances, without returning to a supply base for more gas.

His guess in this direction is ingenious. His balloon was made to ascend or descend, not by alternately throwing out ballast and letting out gas, but by expanding or contracting the gas in the bag by changing its temperature. The bag was large enough to balance the balloon, when not quite filled with hydrogen at sea level and normal temperature. If the hydrogen in the bag is heated, he reasoned, it will expand, its air displacement will be greater, and so the balloon will rise. If, then, the hydrogen is allowed to cool, it will contract in volume, its air displacement will be less—and the balloon will descend.

He therefore put on board his balloon a battery which decomposed water into hydrogen, rising from one electrode, and oxygen, rising at the other. These gases were then allowed to mingle and feed into a blowpipe, which in turn was used to heat a kind of stove much like the modern closed car heater of today. This stove warmed the hydrogen in the bag. "Light the blowpipe!" cries his balloonist—and the balloon shoots up. "Put out the blowpipe," he advises, when he wants to land—the gas cools slowly, and the balloon drifts earthward. All this without the loss of a single cubic foot of gas!

Ingenious, yes—but history has not fulfilled this prophecy. Balloons have covered long distances, and today we watch their cross-country races with excitement; but no such device as that described by Verne has come into use. One would assume, at once, that batteries powerful enough to generate sufficient oxygen and hydrogen to raise the balloon by the heat of their combustion as often as needed during long flights, would be so heavy that the balloon could not lift them off the ground. Verne must have been aware of this, for he has the inventor of this device state that the nature of his batteries is a "secret," that they are made of "new metals and powerful acids" not heretofore discovered. But "new metals and powerful acids," which might make a battery of infinitely light weight and great power, have not been discovered even today.

Courtesy Parke, Austin & Lipscomb

Four illustrations from Jules Verne's books, showing with what amazing accuracy he foretold some of our modern marvels. The two smaller pictures, from "Twenty Thousand Leagues under the Seas," depict the adventurers walking on the bottom of the ocean, and Captain Nemo on his submarine, the *Nautilus*. At the left, the moon projectile of "From the Earth to the Moon," and above, *The Terror*, the strange submarine-auto-airplane of "Master of the World"

IN FACT, the swiftness of mechanical invention and scientific discovery in Verne's day seems to have led him into a fundamental error in regard to the laws governing the generation and behavior of energy. His mistake in this direction is well illustrated by a quotation from his delightful story, "Mysterious Island"— a tale which chronicles the melodramatic death of the inventor of the *Nautilus*, Captain Nemo. In this yarn, his fanciful engineer, Cyrus Harding, says that steamers will burn water instead of coal, and continues:

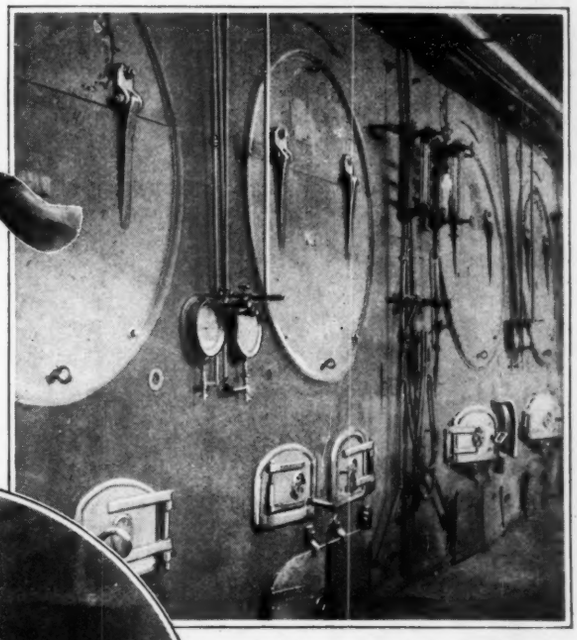
"Yes, water decomposed into its primitive elements, and decomposed doubtless by electricity, which will have become a powerful and manageable force! Yes, my friends, I believe that water will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable. Some day the coalrooms of steamers and the tenders of locomotives will, instead of coal, be stored with these two condensed gases, which will burn in the

(*Continued on page 110*)

He's America's Orchid King!

These flowers took six years to grow!

Thomas Young, the world's greatest orchid grower



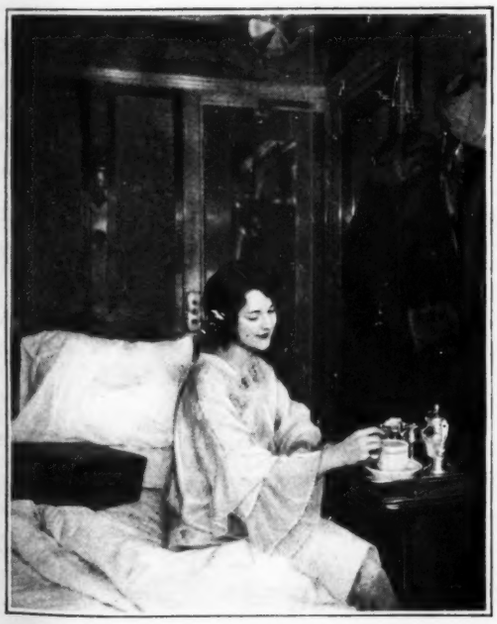
Heating plant of Young's orchid farm

MORE than a hundred thousand orchids a year come from the plant of Thomas Young, Jr., at Bound Brook, N. J. Said to be the greatest producer of orchids in the world, he has devoted twenty years to the cultivation for the market of these prized and costly flowers. Some of his strikingly beautiful plants are shown in the photograph above.

From six to eight years of care are lavished upon each plant before even a single orchid appears. The seeds are planted in a special preparation designed to replace the fungus in which orchids growing wild would take root. After they have been nursed and coddled in glass tubes, such as the one Mr. Young is holding here, the tiny seedlings are transferred to pots. Six mighty boilers keep the hothouses at the correct temperature for the delicate plants. Each year the plants are transplanted until at last they reward the patient grower with their incomparable flowers.

Many rare species with colorings of vivid beauty, such as the *Cypripedium* above, are among the rows of plants in the unique glass-roofed farm.

New Pullmans Substitute Luxurious Bedrooms for Berths



ALL the comforts of home are provided in the latest Pullman sleeping cars, designed exclusively for overnight travel. There are no upper and lower berths; instead, the car contains fourteen luxurious "bedrooms." Each compartment is provided with a full-length bed, a folding table and chair, hot and cold water, electric fans, shaded lights, and a full-length mirror! The two photographs give some idea of the comparative spaciousness of the rooms.

Unlike the old style Pullman, the new cars are not convertible into day coaches. Adjoining compartments have communicating doors, ordinarily locked, which may be thrown open for friends traveling together.

Oomak

Bare Hands

The Triumph of Mechanical Skill and Ingenuity in the Wilds of a Desolate Island

By HAWTHORNE DANIEL

SAVED by shipwreck from the hands of the murderous seal poacher, Kiska Joe, four Seattle yachtsmen—Parker, Thornton, Williams and Kelly—were cast up on the desolate shore of Devil Island in the far northern Aleutian archipelago. With them was Oomak, one of Kiska Joe's crew of native Aleuts. They found shelter in a cave, killed game for food, and later made tools of steel by smelting ore found on the island. Their attempt to build a boat was interrupted by the unexpected appearance of Kiska Joe's schooner. Parker, risking the hostility of the poacher, was seized and bound. The others attempted to resist the invader's armed attack by rolling boulders from a cliff. Just when their plight seemed desperate, a mysterious and dreadful cry echoed through the island. Kiska Joe fled in terror. Later the castaways resumed work on their boat and on an ingenius steam engine to run it. To celebrate the completion of the engine, after many weeks, Oomak prepared a feast. While the men sat at the meal, Oomak, suddenly startled, seized a ladle and flung it into the open doorway. It struck a figure standing in the dark outside. There was a groan, and a body fell across the threshold. It was a woman! Now read on:

Oomak cried aloud and retreated to the back of the cave, where he crouched behind the table in terror. For a moment the white men stood motionless, then Thornton stepped forward. He stooped beside the body and drew aside the hair.

"An Aleut woman," he said. "Help me bring her in."

They lifted her gently and laid her on one of the beds. Williams brought water and bathed her face. A bump on her forehead marked the spot where Oomak's blow had struck, but the skin was hardly broken.

"Stunned," said Thornton presently. "It's a good thing the ladle hit the top of the doorway first. Who the deuce is she?"

The woman lay with her eyes shut, breathing lightly. She was dressed in rabbit skins as they were, and wore moccasins of sealskin. Her face was wrinkled and old, yet her muscular arms suggested strength and vigor. It was impossible to guess her age. She was wild in appearance—savage and unkempt—even more so than others of her kind. Yet her face was not unintelligent.

Thornton turned to Oomak, who was still crouching in the corner whimpering.

"Come here," ordered the engineer, but the Aleut only crouched more closely against the stone wall of the cave.

"Come on, Oomak," wheedled Thornton. "There's nothing to be afraid of. She isn't a spirit or a devil. She's a live woman, and you just knocked her senseless. Come on, and see if you can tell who she is."

WILLIAMS joined in the coaxing, and at last the Aleut crept forward. As his eyes fell upon the face that was lit by the firelight, he started back again.

"Tuginana!" he cried. The woman stirred, as if she had heard the name.

"Do you know her?" asked Thornton.

"Tuginana," repeated Oomak. "She spirit. She dead! Tuginana. Dead—twelve year!"

"She's not dead," returned Thornton. "She's alive, and she'll wake up presently. But who is she, Oomak?"

"Tuginana," he said again, drawing back, still half afraid. "She Kiska Joe's wife!"

The others stared at him. Kiska Joe's wife? She who had been reported dead twelve years ago? What was she doing here?

The woman opened her eyes. For half a minute she lay still, then muttered a single word. "Oomak!"

"Yes," agreed Thornton. "He is Oomak, and we are friends."

"Kiska Joe not here?" she asked.

"No, he's not here."

"You not hurt Tuginana?"

"No, we won't hurt you."

She made an effort to sit up, and smiled faintly.

"I watch you all the time here," she said. "Nighttime I watch. Daytime I watch. You not hurt Tuginana?"

Again they reassured her, and Oomak, partly recovered from his fright, began to prepare food for her.

"How did you come to this island?" asked Williams.

"I live here ten—twelve year," she replied.

"Alone?"

"Nobody—just me. In big cave—there." She pointed vaguely.

"How did you get here?"

She smiled.

"Oomak—he know—maybe."

But Oomak refused to talk. He pottered over the fire.

"Kiska Joe—he think I dead," she said at last. "He much 'fraid of me."

"What do you mean?"

"He keel my child," she replied. "Knock head on schooner—mad!"

"Kiska Joe killed your child?" asked Thornton in surprise, recalling the story the Coast Guard officer had told him.

"HE KEEL child—say I keel," she explained. "We on schooner. He bury child here." She pointed in the direction of the beach. "I very mad—try keel Kiska Joe," she went on. "We fight. I fall over rail."

"You fell into the water?"

"Yes. I fall. Storm make big wave. Schooner sail quick. It go away. I swim."

"You swam ashore?"

"To this land. Yes, I glad. My boy here. I stay."

"How long ago was that?"

"I not know. Ten year. Maybe twelve. I not know."

"Have you seen Kiska Joe since then?"

"Yes, I see. I try keel. He run."

"Why did he come back?"

"To bring present for dead child. I take. I try keel Kiska Joe maybe ten time." She smiled and tapped her breast. "Kiska Joe he 'fraid of me. He run."

"One steam engine, two steam engine, three steam engine." Thornton, the engineer, counted off the seconds aloud, while Williams at the helm steered for his milepost. The craft they had built from raw materials moved steadily through the sea

"Why did he run?"

"He 'fraid," she repeated.

"She spirit. She devil," muttered Oomak from beside the fire.

"That's it," said Thornton to the others. "Kiska Joe thought she was dead, so naturally he ran when she came after him. Conscience."

"Why did you come here tonight?" asked Williams.

She smiled.

"I come every night—long time. I see you work. What you make?" she asked suddenly.

"YOU mean, what have we been making?"

"Yes."

"A boat."

"You go away?"

"Yes. Before long."

"You take Tuginana?"

"Certainly. Where do you want to go?"

Her mild features changed suddenly. Her eyes glittered, her teeth clenched. A deep frown cut her forehead.

"I go to Kiska Joe—I keel him!" she whispered.

"But why did you come so close to us tonight?" asked Thornton after a moment.

The hard face melted again into a smile, and she looked to where Oomak was cooking fish by the fire.

"I smell beans," she said. "Not eat beans for long time. I come close to smell. I think maybe I get some, like I got ham."

"Oh, you took the ham, did you?" asked Thornton. "Did you take the axe, too?"

"Yes."

"And you made the picture of the bird on the rock?"

"Yes."

"What for?"

"I will keel Kiska Joe," she whispered fiercely.

"Then that wasn't meant for us?"

"No! No! For Kiska Joe. Not you."

They saw it all plainly now.

"Anybody else would have gone insane," said Thornton. "But all she has done is to develop a monomania. She wants to kill Kiska Joe, and I can't say I blame her much. He deserves it. But of course, he's been afraid, too. He has come here to leave offerings to the spirit of his child, and has seen her every time. She rushed at him to try to kill him, and he thought she was dead. No wonder he ran. Anyone would have done the same."

Tuginana, having learned that they were getting ready to leave the island, went back to her cave only to get the axe. She helped Oomak, and made it possible for him to help with the engine. He grew accustomed to her presence, and when he learned that she had been the one who had uttered the frightful shrieks they had heard—the first time because she thought Kiska Joe had come ashore, and the second time because he actually had come—Oomak began to feel more reassured, for that eliminated one of his devils. Then, when she told them that she had pulled Tuginak's body into the cave after finding it during the midnight storm that had washed it up—had pulled it in there to learn who it was—Oomak began to feel quite friendly. And when she admitted having taken the axe, the ham, and a number of his smoked rabbits, he decided there was nothing devilish about her, and so permitted her to assist him, and even to do most of his work.

ACCORDING to their calendar, Tuginana had appeared on the evening of the fourteenth of September. It began to look as if they might be ready to leave the island in two or three more weeks. With their goal so near, the white men labored even harder than they had worked before.

The time was approaching when they would put to the test the boat and the engine they had built. Would their handiwork stand the strain of several days at sea? Would they be able to get to some inhabited land before the crude engine wore out or broke down? Would they be able, at last, to set the Coast Guard on Kiska Joe's trail with the hope that Parker might still be rescued? Or would they find that their friend had been brutally murdered long before? Would the plans that they had worked out miscarry? Or would they manage to succeed?

The result was on the knees of the gods, and all the castaways could do was to work and prepare, in an effort to forestall every possible difficulty. For soon they would take their lives in their hands, and set out to sea on the cockleshell that they had built from the raw materials the island had provided.

Installing their machinery in the boat proved simpler than

Installing the machinery proved simpler than they had expected. They moved the heavy engine on improvised rollers cut from logs, and then hoisted it aboard on inclined skids

they had thought. They moved the heavy engine on improvised rollers cut from logs, and hoisted it aboard along inclined skids. The engine was placed with a boiler on each side, to save space in the little vessel, and so that one man could readily be stoker and engineer. When they had bolted the engine in, Thornton went off to make the propeller and the propeller shaft, while the others connected the boilers, made bricks of clay for the fire boxes and a funnel of steel plates.

WILLIAMS had whittled out the pattern for the propeller during the evenings of the preceding two months, and prided himself upon its perfection. But the casting was not simple. Still, it was done, and a square hole was cast in the hub for the shaft. October came before the boat was complete and ready for her launching.

They took their sealskin of oil aboard, and lavishly oiled their machine. The boat was excessively heavy, and it took them a day to push her down the ways into the water, but at last she was afloat. Williams and Kelly looked her over carefully for leaks, and plugged a dozen. But overnight in the water served to swell the planks and make her tight.

Thornton worked over the machinery. He filled the boilers with water, and tightened the spigot throttles and a dozen joints. He got up a little steam and opened the throttles very gently, but was forced to re-time the inlet and exhaust valve. Again he opened the throttles, and the flywheel turned suddenly. He stoked up the fires and opened the throttles wider. The engine ran with a terrific clatter. Groans, clanks, wheezes and weird sounds came from a dozen sources. The vibration was so violent that he was forced to install metal braces from the cylinder to the keel and to the bulkheads—but the engine ran! The nose of the boat was against the clay of the little river's bank, and the propeller, unable to push the boat ahead, sent a slowly moving stream of foamy water toward the other bank.

The group watched with their hearts in their throats. For five minutes Thornton let the engine run, and when he shut it down at last, his companions were too happy to cheer—too delighted to do more than go quietly ashore with thankfulness in their hearts.

They dug through the sand bar at the mouth of the stream, and loaded their little ship with charcoal and fuel, and with sealskins of fresh water. During the summer they had caught eight seals. Two of the skins had gone to make the belt that ran the lathe. One served as a container for their oil. Five others were filled with fresh water, four of them for the boilers, the other for drinking. They had eliminated the task of building tanks for their water, and had decided against a condenser as too difficult to construct. They would fill the boilers full of fresh water when they started, and when this and the reserve supply in the sealskins ran out, they would use salt water.

"But won't that cake in your boilers?" asked Williams.

Thornton nodded.

"Still, we can make it do, and a trial trip will show us how far our fresh water will carry us before we have to turn to salt."

"How far shall we go on the trial?"

"Around the island."

EARLY the next morning they set out. Oomak and Tuginana were left behind with instructions to get together enough food for the trip, and to gather up what belongings they wished to take.

The engine started, and with Williams at the tiller, they slid noisily downstream. They grounded on the sand bar, but got off immediately, and made their way into the open sea. A heavy swell was running, and until they had gone a quarter of a mile offshore they pitched fearfully. Once outside they turned to the north. Williams, having marked off what he estimated to be a mile, from the mouth of the stream to where a rock rose prominently on the beach, steered for his milepost while Thornton counted to himself as the boat proceeded.

"One steam engine, two steam engine, three steam engine," he counted aloud. "Four steam engine, five steam engine, six—"

"What the devil?" asked Kelly of Williams. "He ain't gone crazy *now*, has he?"

"Shut up," ordered Williams. "He's timing us."

"Timing us? How?"

"You try it yourself, sometime. Say 'one steam engine, two steam engine, three steam engine,' and keep it up until you have counted sixty. Then check yourself up with a watch, and you'll find, after a little practice, that you can come within two or three seconds of a minute every time."

Kelly listened to Thornton as he counted. "Fifty-one steam engine, fifty-two steam engine, fifty-three steam engine," and below the engineer felt the bearings of his engine, watched his water gages, oiled, turned the throttles a trifle, and opened the cast-iron doors to the fire boxes to throw charcoal on the fires.

"Gee," remarked Kelly, from where he was standing on the bow deck. "Ain't those fires beauties? You can feel the heat from 'em clear up here. Bright, too, ain't they now?"

"One steam engine, two steam engine, three steam engine," they heard Thornton, still counting. "Four steam engine, five steam engine—"

"Time!" shouted Williams.

"Have we made the mile?" roared Thornton.

"Yes. How long did it take?"

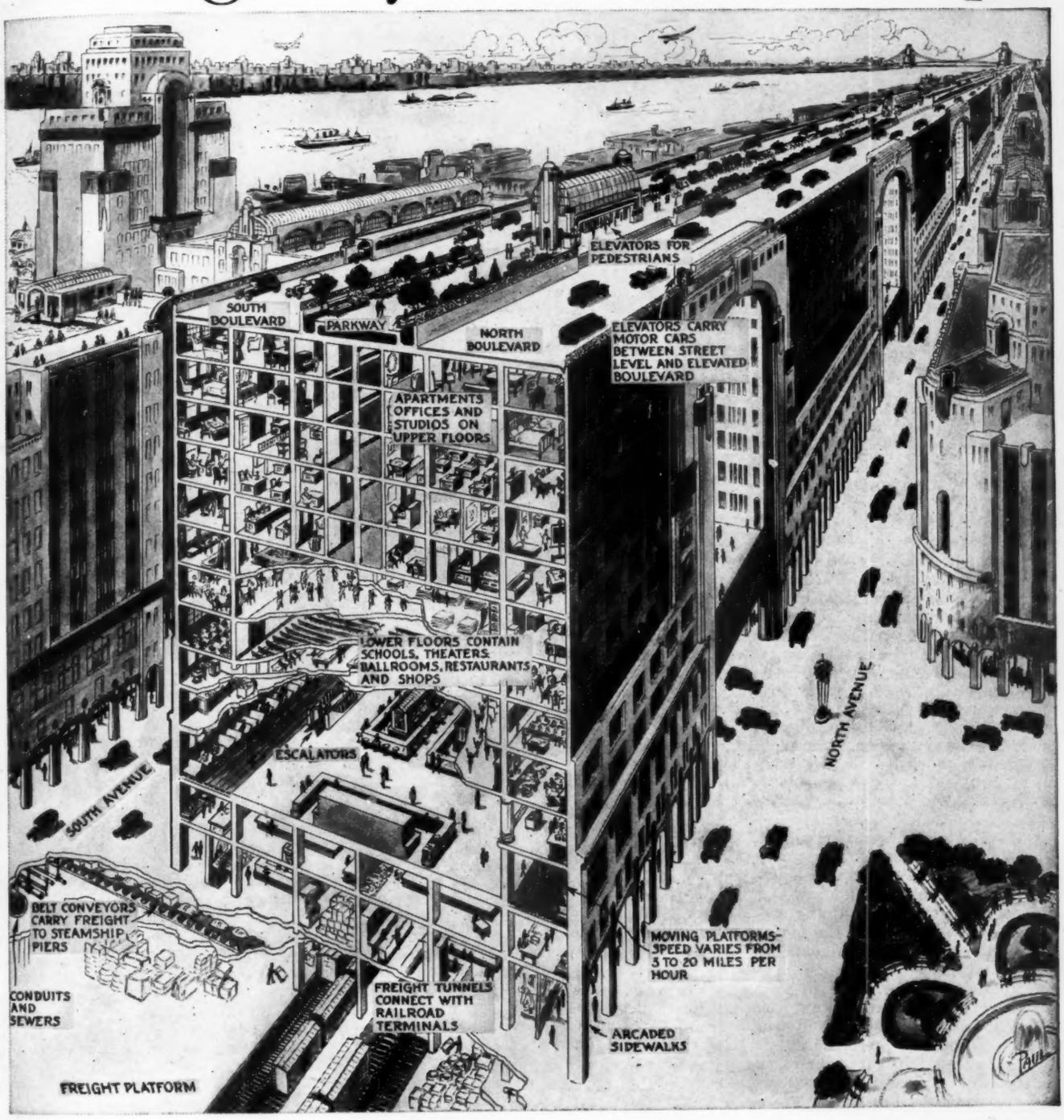
"Ten minutes and five seconds—nearly six miles an hour. Not so bad," Thornton smiled as he looked out at the two on the deck. "And you know, no engineer will ever admit that a new engine won't improve. If this one gets worn in before it's worn out we'll do better than that."

IT WAS roughly twelve miles around the island, and for a part of the way they ran against a mild current, but having started within an hour after sunrise, they returned to the creek by the time the morning was half gone.

Ashore again, Thornton went to work at once with forge and hammer and grindstone to make small repairs and adjustments. But they were almost ready, and three days later, in a sea that had grown calmer, they lifted their last remaining supplies aboard, took Tuginana and Oomak over the side, and amid clanks and hisses, slowly made their way down the little stream and out into the smooth, cold sea.

With high hopes, the castaways are embarked on their desperate adventure back to civilization. What does the treacherous sea hold in store for them? And what of Parker and Kiska Joe? The final installment next month is loaded with thrills and swift action.

A Highway *on the* Roof Tops


ELEVATORS FOR PEDESTRIANS
SOUTH BOULEVARD
PARKWAY
NORTH BOULEVARD
ELEVATORS CARRY MOTOR CARS BETWEEN STREET LEVEL AND ELEVATED BOULEVARD
APARTMENTS OFFICES AND STUDIOS ON UPPER FLOORS
LOWER FLOORS CONTAIN SCHOOLS, THEATERS, BALLROOMS, RESTAURANTS AND SHOPS
ESCALATORS
SOUTH AVENUE
NORTH AVENUE
BELT CONVEYORS CARRY FREIGHT TO STEAMSHIP PIERS
CONDUITS AND SEWERS
FREIGHT TUNNELS CONNECT WITH RAILROAD TERMINALS
FREIGHT PLATFORM
MOVING PLATFORMS—SPEED VARIES FROM 5 TO 20 MILES PER HOUR
ARCADED SIDEWALKS

New York Engineer Proposes 16-Mile Elevated Speedway as Traffic Aid

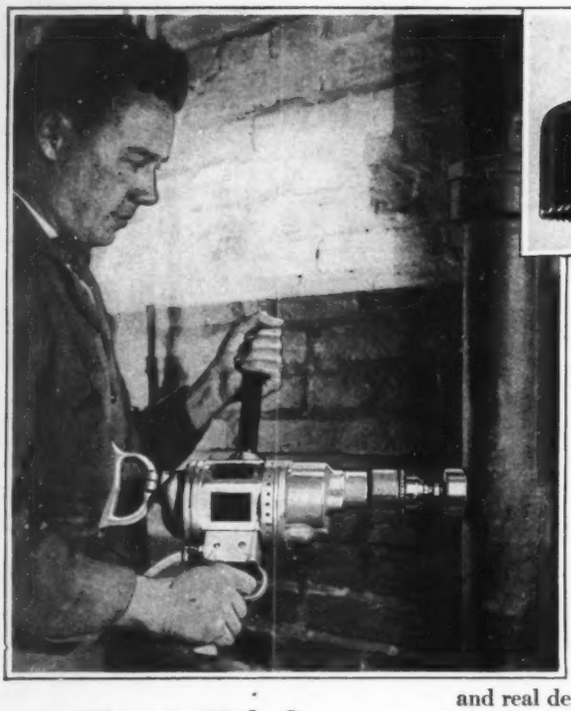
OUR artist pictures here an ingenious new plan for solving New York City's traffic problems by a remarkable system of roof-top boulevards running more than sixteen miles in a straight line through the heart of the city. Bridging of cross streets for free movement of traffic; moving platforms for speedy and convenient passenger service; healthful elevated playgrounds for children; underground railway freight service—these are some of its outstanding features.

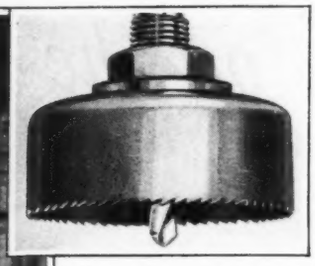
The proposed system, conceived by John K. Hencken, a New York engineer, has been approved by a number of eminent engineers and city planners. They say it is entirely feasible from an engineering standpoint. It calls for a series of buildings of uniform twelve-story height extending from the lower tip of Manhattan Island to Yonkers, connected by bridges at all cross streets.

Sub-basements would contain four railroad tracks for freight service, as well as conduits and sewers. The first floor, arcaded to form a ten-foot sidewalk, would be devoted to stores and shops.

Through the second or main floors, continuous moving platforms for free passenger service would run at graduated speeds ranging from three to twenty miles an hour. These platforms also would be carried on bridges over cross streets. Other lower floors would be occupied by retail shops, restaurants, theaters and so on. The upper floors would be used in business sections for offices; in residential districts for apartments and studios.

North-bound and south-bound boulevards on the roof-tops would be separated by a protected parkway, reached by elevators. Other elevators, in every block, would carry motor cars from the street level to the elevated boulevards.





Steel cup of the saw. A ¼-inch drill bit acts as a pilot for locating the hole and for guiding the saw

Electric Hole Saw

YOU don't "bore" a hole with the device pictured above—you "saw" it. The device—an odd-shaped circular saw—is inserted on the end of an electric drill, and revolves at high speed, cutting a large, round hole through metal or wood. It follows the guiding path of an ordinary twist drill mounted at its center, whose tip projects a trifle beyond the rim of the saw teeth.

Unusual holes are easily and quickly made with this new tool. In the illustration a plumber is preparing to make a connection to the soil pipe in a basement. Another size cuts a neat hole in an automobile instrument board to insert a new instrument or a clock.

KNOW YOUR CAR

ONE of the peculiar things about the ignition system is that it rarely gives warning of an impending breakdown. Of course, if the points are becoming corroded so that the motor begins to miss, you are being served notice that the points need attention. Ordinarily there is little danger that the condenser or spark coil will break down; consequently it doesn't pay to carry an extra coil or condenser, unless you are going into territory where there are no service stations.

Spark plugs do give out at times, so it is always well to carry a couple of spares. Wire and insulating tape also may come in handy. To feel safe about your ignition system, observe the following rules:

1. **Inspect the breaker points and the timer mechanism before each long trip.**
2. **Carry spare spark plugs, wire and tape.**
3. **Look over the wiring occasionally to make sure that nothing is coming loose.**

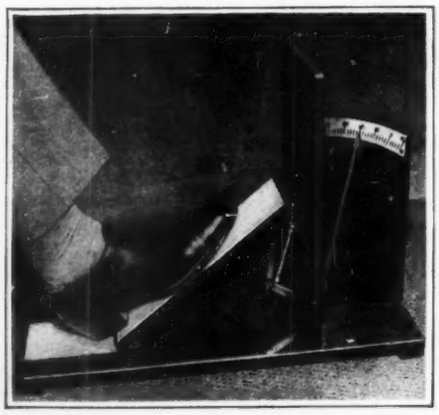
Movies That "Live"

MOTION pictures that seem to have vivid and real depth, with near and far objects standing apart from each other, are obtained with a stereoscopic camera invented by Harry K. Fairall, of Hollywood, Cal. The camera's two lenses, their shutters working simultaneously, make double pictures. One picture is then printed in green and the other in red. Projected on top of each other on the theater screen, they do not quite match, for they were taken from slightly different angles.

When looking at the twin picture, a two-holed eyepiece with red and green glasses is used. Only one image is therefore visible to each eye; and the combined effect is as if the eyes themselves, instead of the camera's lenses, had viewed the original scene.

Tests Autoist's Footwork

HOW steady is your foot on the accelerator or brake pedal? In Germany, the Berlin license officials have devised an ingenious apparatus, pictured below, to test would-be auto drivers. While the applicant responds to commands intended to excite and confuse him, to correspond to emergencies that might arise on the motor highway, a sensitive needle registers the steadiness of his foot pressure on an imaginary control.



The moving needle gages the foot pressure exerted under varying degrees of excitement

It Measures Furnace Heat

WHERE the blistering heat of a flaming furnace is too intense to permit a man to come near it, this new hand pyrometer, pictured below, takes its temperature at a safe distance. The operator simply sights through the eyepiece at the open furnace door, presses a button, and a needle on the scale instantly shows the fire's temperature.

The device is for use in steel plants and other places where terrific heats must be known accurately. Within the instrument the fire's heat is focused on a "thermocouple," two joined strips of unlike metals. As the thermocouple is heated, the tiny quantity of electricity generated is indicated on a dial that interprets it as equivalent to so many degrees of temperature in the furnace.

Simply holding it at a safe distance from a blistering hot furnace measures the heat

Houses of Rammed Earth

MOST soils are perfectly suitable for rammed earth houses, says Dr. H. B. Humphreys of the U. S. Department of Agriculture. He recommends earth that forms in clods when dug, or that, in a footpath, remains hard in wet weather. It is better for the amateur to try his hand at a small building, perhaps a garage, first, he says, to practice handling the earth. An ordinary roof and concrete floors make the rammed earth dwelling complete.

Anyone who has a plot of ground can build himself a rammed earth house with his own hands, says Dr. Humphreys. The dirt removed in excavating will be more than enough for the walls.

Shows When Gas Is Poor

HOW much heat your gas contains can now be measured by a simple calorimeter, or "heat-meter," devised by Prof. S. W. Parr of the University of Illinois. With it gas companies can tell in advance the quality of the gas they send out, long before complaints that the gas does not burn properly might come pouring in.

Plugged into the gas supply line, such a calorimeter consists of a burner that heats running water circulating in a metal jacket around it. The number of degrees that the water rises in temperature, in passing through the apparatus, is read directly on a scale as a measure of the quality of the gas.

New York's Storm Detector

POWER stations that supply New York City with electricity are now warned of approaching thunderstorms by a new radio device, so that they may prepare for the peak load when lights go on throughout the city as it finds itself in darkness.

The thunderstorm detector starts ringing a bell at intervals when the storm is still 200 miles away. When the storm is only half an hour's distance from the city, though the sky may still be clear, the bell rings continuously, and all the generating stations are signaled to prepare for the increased load.

The apparatus used is similar to a radio, but is arranged to record the presence of static rather than discard it.

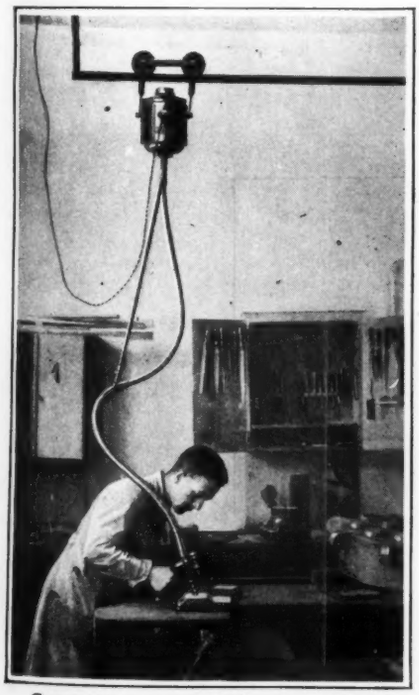
Whitewashes Defy Heat

NEW whitewashes that can stand heat have recently been announced before the American Chemical Society. To be used in factories where they are exposed to high temperatures, the lately discovered compounds, which contain lime, were described as being durable, economical, easy to apply, and capable of giving a brilliant white coat. Several months' exposure to severe heat, it was said, had not harmed them.

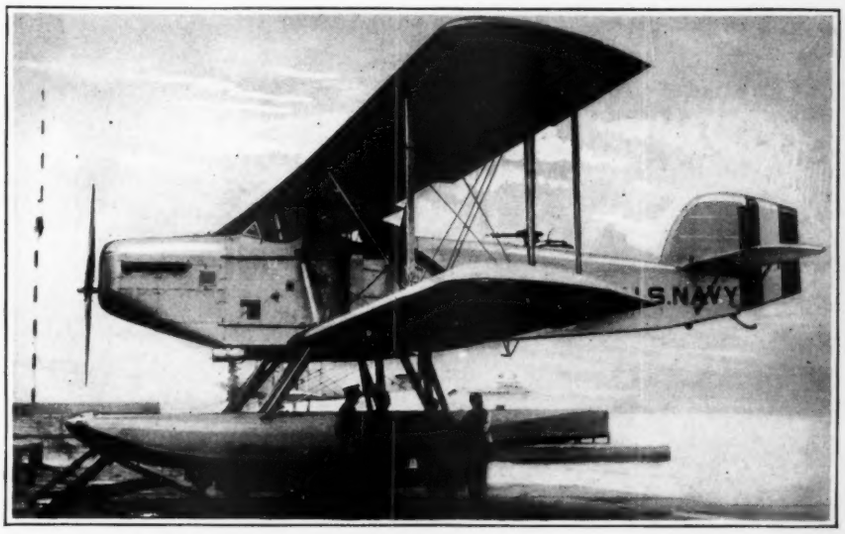
The paper on the new whitewashes was read to the Society as part of a symposium on lime, directed by Prof. J. R. Withrow, of Ohio State University.

Ingenious Combination Tool

A REMARKABLY versatile power-driven tool, shown below, is being used in German workshops. At its business end may be attached interchangeably a revolving cutter that bores and trims, or a planer for smoothing the edges of boards. Through a flexible cable, the device is run by an electric motor suspended overhead or placed out of the way at the end of the workbench.



Connected to an overhead motor, the tool can be used with ease in unusual positions



A Triple-Purpose War Plane

BOMBER, torpedo plane and scouting machine, the latest naval airplane, pictured above, is a "triple threat" indeed. Tested recently at Anacostia, D. C., it carries its pilot and observer in protected cockpits below the wing, while a machine gunner at the rear pours a withering fire upon enemy planes. With a touch of his control, the observer can loose a death-dealing bomb from beneath the fuselage or launch a torpedo as the plane darts toward a hostile warship.

Three Lanterns in One!

HERE'S an electric signal lantern that, according to the maker, "will never leave you in the dark," for it has three lights instead of one. Up-end it, press a switch, and from a bulb concealed in a reflector in the base a powerful spot light will beam forth. For signaling, a broader beam comes from a bulb near the rim, and a red light shines from the side. It was designed especially for railroad men.

To save the battery, the switch turns off the spotlight when the signal light goes on, and vice versa. The red side light is independent of the other two.

Gold Plucked from Air

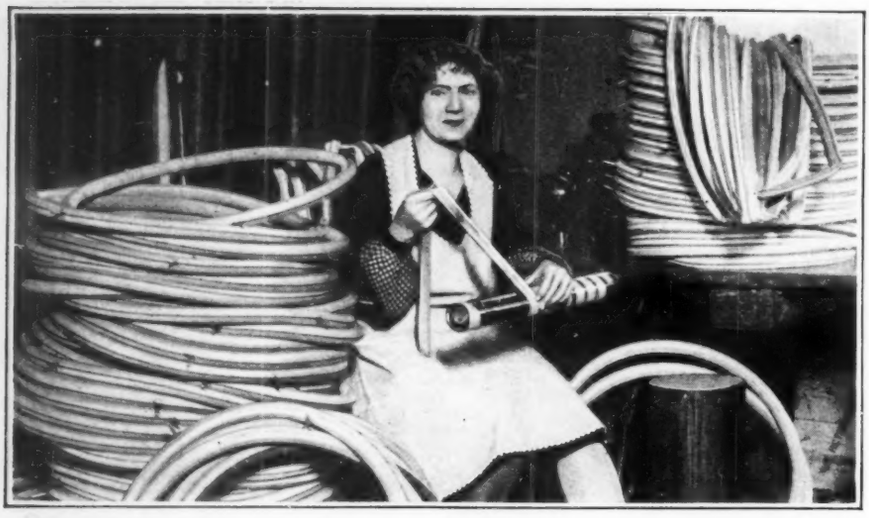
UNCLE SAM is literally picking gold out of the air through a device in the U. S. Assay Office, New York City, which recovers metal that formerly went up in fumes from the smelting of bar gold. Six hundred ounces of gold, valued at $12,400, have thus far been recovered from the dust.

Driven up the stack by a giant fan, the gold-bearing fumes from the furnaces pass between two metal plates charged with high voltage electricity. Gold particles suspended in the gases become electrified and settle on the electrodes, whence they fall or are shaken into a collecting chamber below.

How Much Do You Know of the World You Live In?

TEST yourself with the twelve questions below, selected from hundreds sent in by our readers. For the correct answers turn to page 135.

1. **What is the only active volcano in the continental United States?**
2. **What is the longest river in the world?**
3. **How were the Aleutian Islands formed?**
4. **Where did prehistoric people build stone apartment houses?**
5. **Where do sponges come from?**
6. **Where is Portuguese spoken in America?**
7. **Where is the "Blarney Stone"?**
8. **What animal keeps African rivers from being choked?**
9. **Where was writing invented?**
10. **What is the highest mountain in the world?**
11. **What islands have the fewest insects?**
12. **Where are there clams large enough to kill a man?**



She Makes Bike Tires

MAKING tires for racing bicycles is the unusual specialty of Mrs. Ernie Pye, of Newark, N. J. Her late husband, a star cyclist, who had perfected a special tire for racing, left her his patents for the process. Now Mrs. Pye herself manufactures the tires at her Newark shop.

Each one is made to order for her customer; she numbers in her clientele virtually all American racing cyclists, professional and amateur. Some riders want heavier tires than others, some a trifle larger or smaller, according to the kind of race in which they are to be used. Whatever their needs, Mrs. Pye tries to fill them.

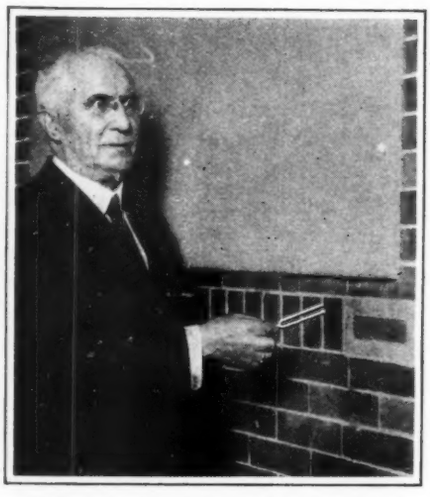
Seven tiers of woven thread, with alternate layers of shellac, go into the tread. The inner tube is made of extremely thin Para rubber. Large drums support the embryo tires during the weaving operation.

World's Biggest Vacuum Tube

THE largest vacuum tube ever made for radio broadcasting, with a power of 100 kilowatts, was recently installed by the General Electric Company at its station WGY in Schenectady, N. Y. Seven and a half feet high, the giant tube weighs a hundred pounds. Its tungsten filament is as thick as a lead pencil, and a water jacket of copper tubing keeps it from overheating. Used to amplify the output of a husky twenty-kilowatt tube, the new monster will hurl a radio wave of unheard-of power to aid in transmission experiments.

New Auto Motor

MOTOR fuel costs can be cut to five cents a gallon, claims Walter S. Rohn, consulting engineer, of Needham, Mass., with an amazing new automobile motor he has invented that has no spark plugs nor connecting rods. Like the huge Diesel engines used to propel ships, it will burn low-grade oil instead of gasoline. An odd-shaped cam on the crankshaft receives power directly from a roller mounted on the piston. Heat generated by terrific compression ignites the fuel mixture in a "slow" explosion.



Blocks Improve Acoustics

HOPE for better acoustics in large halls and theaters is held out by the perfection of new concrete building blocks, the latest contribution of Emile Berliner, inventor of the microphone, disk phonograph records and other devices.

Berliner's new blocks are described as having all the acoustic properties of wood. In the illustration, the inventor is testing with a tuning fork the sound qualities of the blocks installed in the assembly hall of a school in Washington, D. C. Once a place of extremely bad acoustics, it is now said to make a child's voice audible seventy-five feet away.

W. S. Rohn, Massachusetts engineer, with the plans for the new auto motor he has patented. Heat generated by compression ignites the low-grade oil that it burns in place of gasoline

Paper from Old Dollar Bills

WORN-OUT dollar bills will no longer be a loss, but a source of profit to the Government. As a result of experiments by Government experts, a way has been found to convert the four tons of condemned bills returned each day to Washington for destruction into fine writing paper.

With new machinery, the colored ink is now removed from the bills, so that the resultant pulp is of a quality suited for a first-class grade of stationery. Hitherto the bills destroyed have produced only a worthless pulp, which was sold to souvenir makers.

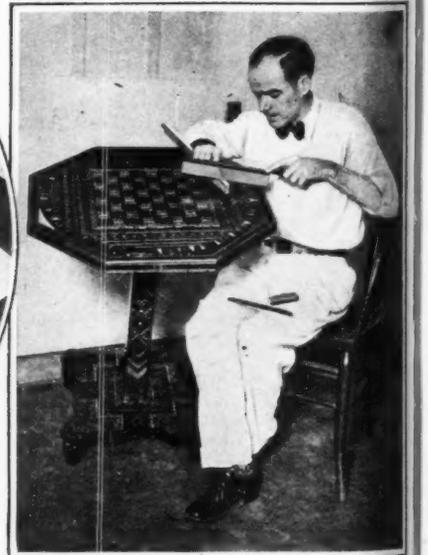
Furnace Feeds Itself

MECHANICAL hands tend your heating plant in a new domestic furnace recently exhibited in New York. Coal fed from an automatic hopper outside the furnace is distributed in the fire by a revolving grate. Set a control lever at hot, medium or low, and you can go away and let the furnace stoke itself.

A Table of 51,000 Parts

FROM all over the world came the 51,000 bits of wood with which George L. Hathaway, of Cincinnati, Ohio, constructed the remarkable inlaid chess table below. Among them are fragments from the famous chestnut tree at Cambridge, Mass., beneath which the "village smithy" stood; a rare piece of African cork; and a piece of the first navel orange tree imported from Spain a century ago.

These and the others Hathaway whittled into shape with a pocketknife, trimmed with a handsaw, and laboriously glued in place. He traveled 13,000 miles to collect his material.



George L. Hathaway at work on the amazing chess table whose construction took 41 months

Cutting Steel with Iron

IT MAY seem surprising that it is possible to cut a bar of steel, even of the hardest tool material, with a smooth disk of soft iron—and yet it can actually be done. The iron disk, slightly roughened at its periphery, is rotated at high speed, so that any point of the periphery travels at least 300 feet a second. If a steel bar is pressed against the rotating edge of the disk, the friction will transform a great amount of energy into heat, which melts the steel. The greater part of the molten steel is thrown off by the centrifugal force of the rotating disk in the form of a shower of brilliant sparks, but a small part becomes welded to the cutting edge of the disk. The disk, contrary to what one might expect, does not become excessively hot, because it is cooled by its rapid motion through the air.

To Cross Ocean in Sailboat

IN A twenty-foot sailboat, Paul Muller, of Berlin, Germany, plans soon to cross the Atlantic. After twenty years as a convict, he intends to start life over again in South America; he should reach its shores, he estimates, after three months on the water, though he will have only a compass to guide him. Despite the fact that Muller has never been to sea in all his forty-one years, he steadfastly refuses to believe that his hazardous voyage may end in disaster.

German ex-convict and the tiny craft in which, with only a compass to guide him, he plans to cross the ocean, to start life anew

He "Clocks" the Big Races

WHEN racing automobiles come hurtling around the speedway on the home stretch, the man at the finish line must have remarkably keen eyes to pick the winner. This is the difficult job of Odis A. Porter, of Indianapolis, Ind. Timer of big auto races, he shares with his unique time-registering device, shown in the illustration, the distinction of being the only timing combination in the United States approved by the International Aeronautical Federation, world governing body of air racing.

French Build "Ghost" Plane

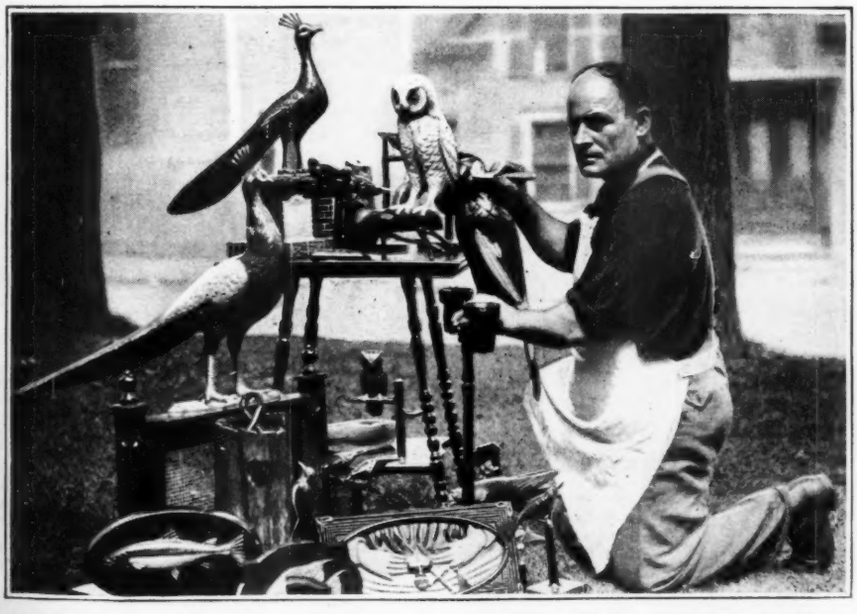
INVISIBLE and silent in the darkness of night, an amazing plane being developed by the French aviation service may be a new terror in future warfare. Equipped with newly designed silencers for the engine, such a plane, it is said, has flown unheard at a height of only 300 feet from the ground. A special paint on the wings and body merges the plane with the dark night sky, hiding it completely from observers only a few hundred feet away.

Silence and invisibility would add immeasurably to the death-dealing powers of airplanes, according to experts, especially for night attacks. During the World War the purring of planes was usually sufficient to get the enemy defense guns into action.

"Mystery" Burglar Alarm

NO WIRES or visible electrical connections betray the presence of an amazing new type of burglar alarm invented by a young French engineer. A field of radio waves is set up in the room to be protected, and the apparatus is adjusted until the electric circuit is in a state of equilibrium. As a burglar steps into the room, the slight disturbance the mere presence of his body makes in the charged room is enough to unbalance the electric circuit and ring a gong that gives the alarm. After a number of tests, the apparatus has been installed in Paris to protect valuable state papers at the Spanish embassy.

Lumberman Models Forest Creatures in Wood



THESE amazingly lifelike models of wild creatures were carved out of solid wood by Alfred La Clair, lumberman, of Biddeford, Maine. The only tool that he used was an ordinary jackknife.

One outstanding example of La Clair's ingenuity is the figure of a bear, now placed on a roadside near Black Lake, Canada. This was hewn out of a solid tree trunk with an axe, then finished with the knife.

"Taxis" Old and New in the Sahara

FOR many years the sole recourse of desert travelers, the camel is at last finding a rival in the tractor automobile. The photograph shows the tentlike cabin or "bussoura," age-old device carried on the camel's back to protect the traveler against the blistering heat of a protracted march. Near by are two fleet automobiles of the French military transport service, equipped with special caterpillar treads, which are regularly engaged in making trips across the rapidly shifting sands of the Sahara desert.

Ice Lowers 16-Ton Floor

SUNSHINE and ice took the place of jacks in a recent unique engineering feat at St. Petersburg, Fla., when a sixteen-ton concrete slab, the floor of a pier bandstand, had to be lowered. Desiring to drop it from its two-foot height above the pier to a height of six inches, engineers found their screw jacks too bulky for the job. They therefore raised the floor slightly and set thirty-two fifty-pound cakes of ice under it, meanwhile arranging the new underpinning. As the ice melted in the brilliant sunshine, the floor settled gradually and successfully to its new foundation.

Armor for Matador's Horse

SPAIN'S famous bull fights are becoming more humane and less gory—for horses, at least. To guard against the horns of a charging bull, the matador's mount must now wear padded armor like that illustrated above. The matador still must shift for himself.

Salt Lake Changes into Fresh

AGRICULTURE in the vicinity of Honolulu, Hawaii, has played an interesting part in the novel phenomenon of turning a salt lake into a fresh-water lake. Originally connected with the sea by an underground passage, the volcanic lake crater of Salt Lake was lined with hundreds of tons of salt where evaporation had occurred. When great areas near by were recently plowed for sugar cane, rain and irrigation carried silt into the lake and plugged the sea opening. Now fresh-water streams have washed away the salt and the former salt lake is a reservoir.

To Remove Unwanted Grass

GRASS or weeds growing on garden walks or other places where they are not desired, can be removed easily and quickly by scattering a few handfuls of finely crushed ferrous sulphate of iron, commercially known as green vitriol, over the spots, and then about half that much of powdered potassium chlorate. Sprinkle the dusted area with water and await results. In the presence of moisture and atmospheric oxygen, the ferrous sulphate is oxidized to ferric sulphate, which gradually changes to iron oxide, releasing the sulphuric acid with which it was combined. This acid is in itself highly destructive to vegetation, and its effect is increased materially by the chlorine generated by the reaction of the acid with the potassium chlorate.

Brushes from Chinese Pigs

HOGS don't remind most people of paint brushes, yet they furnish the bristles for hundreds of thousands of them. The finest bristles for the best brushes come from the pigs in China. The Chinese workmen grade the bristles according to stiffness, elasticity and flexibility, and also sort them into lengths. The bristles of each length are tied up in small bundles, the root end turned in one direction and the split end in the other. The root end is bound into the ferrule of the brush and the split end spreads the paint or varnish.

Is Quiet Necessary for Good Golf?

HORNS, whistles and tin pans sounded lustily during a unique golf tournament recently held at Atlanta, Ga. Women golfers who participated sought to prove that the quiet demanded by men players was unnecessary for the game, if the players exercise proper mental concentration. As each player made a stroke, spectators hooted and cat-called in efforts to distract her attention. Another novel feature of the tournament was that each member had to play the entire course with a single club, selected at random from the bag.

Does noise disturb the golfer? These women put that convention of the links to the test

---

WHEN YOU BRUSH your teeth, allow the lather to remain on a little time before rinsing, to heighten the germicidal effect, advises the U. S. Army Medical Corps. The ordinary soap contained in most preparations for the teeth is said to be a valuable antiseptic.

Science Explains "Bloody Rains"

"SHOWERS of blood," the terror of people of ancient times, are no longer a mystery to science. When such a shower of red rain fell a few weeks ago in southern France, microscopic examination of the "bloody drops" showed them to contain colored dust blown across the Mediterranean from the Sahara.

Volcanic eruptions, and possibly meteoric dust from shooting stars, have at other times produced colored raindrops. Sometimes the fluid deposited by certain butterflies just before they take flight for the first time leaves a "bloody rain," of red drops spattered over rocks and earth. Vari-colored rains have been recorded, from white, due to chalky earth, to "ink," due to smoke or soot. "Yellow rain," not infrequent in the United States, has been traced to pine tree pollen.

Other "miraculous" showers—of fish and frogs, for instance—have actually occurred when tornadoes or waterspouts passed over shallow water and sucked them aloft. But on at least one occasion a reported rain of frogs was traced to torrential rains that washed away a muddy layer of earth and exposed a vast number of frogs that had lain buried in the ooze.

Stomach Can Be Photographed

SCIENCE at last has found a way to photograph the inside of the stomach, according to reports from Germany. A tiny camera containing seven films is inserted directly into the stomach on the end of a tube. It takes a complete set of pictures of the stomach's actions in fourteen seconds' time. The operation is said to be entirely painless, and the results obtained much more satisfactory than X-ray pictures.

Test Machines in Padded Cell

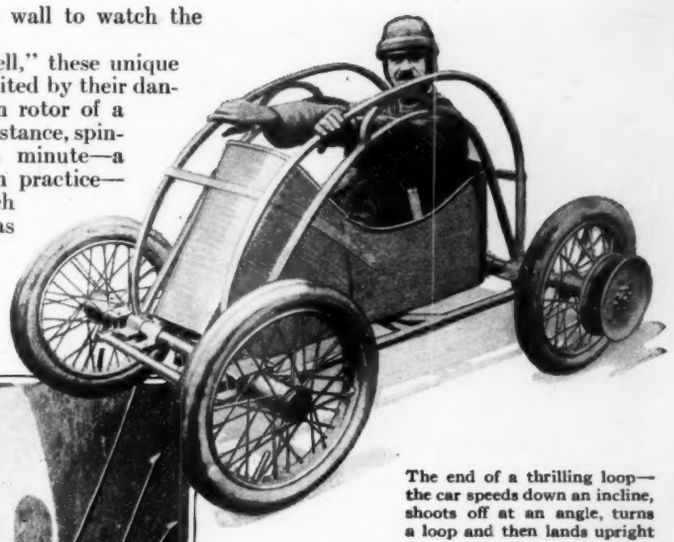
THE strangest "padded cell" in the world has just been completed at Manchester, England. Not intended for human occupancy, it is being used by an electric company to test to the breaking point high-speed machinery. Cushioned walls of reinforced concrete nine feet thick protect observers from flywheels and other machine parts that are likely to fly apart under terrific speed. Telescopes and fast camera lenses peer through holes in the wall to watch the tests.

Without such a "cell," these unique tests would be prohibited by their danger. The twenty-ton rotor of a great generator, for instance, spinning 3,000 times a minute—a not unusual speed in practice—could loose as much destructive energy as that of a head-on collision between two ten-car railroad trains speeding at forty miles an hour!

Ship Plastered with Oysters

IF YOU'VE ever wondered what a ship must look like after it has lain at the sea's bottom for several years, the photograph above will give you a good idea. Raised from the bottom of Chesapeake Bay after seven years beneath the waves, the S. S. *Wotan* was found to be a first-class oyster bed! Thousands of oysters covered every exposed inch, including the propeller. The photograph shows how the bivalves had to be scraped off with long poles when the ship was brought into dry dock at Baltimore, Md.

Wells, the King's ranger, corners part of the herd and selects a fine deer



The end of a thrilling loop—the car speeds down an incline, shoots off at an angle, turns a loop and then lands upright

Loops the Loop in Auto

TEARING down an inclined runway in his acrobatic car and looping the loop at the end of it is an everyday affair for Sieg, German daredevil. He has put guide wheels on the back of his motorless car to flip him off at the right angle.

Deaths from Heart Disease

CONTRARY to popular belief, death from heart disease seldom occurs suddenly, according to a recent statement by Dr. T. Stuart Hart, New York specialist. Most types of heart disease, he says, result in prolonged, gradually increasing invalidism before death; the types of heart disease in which death may come abruptly form a very small group compared with the type from which the great majority of patients suffer.

Theater Teaches Traffic Laws

A THEATER expressly for motorists and pedestrians, with six free performances daily, is being run by the police of Frankfort-on-Main, Germany, to instruct the public in traffic laws. The stage represents an avenue with several street crossings, complete with sidewalks and lamp posts. Automobiles, horses and wagons, pedestrians, even a nurse with a baby carriage, perform their parts in the drama. Every imaginable violation of the law is portrayed, with police and chaffeurs indulging in instructive repartee.

Staging a Deer Rodeo

SOMETHING unusual in the way of rodeos occurred the other day in England, when Sir Henry Dering staged a round-up of the 400 deer on his Ashford, Kent, estate. Under the direction of Wells, the King's head ranger, more than fifty deer were selected and sent all over the country, to bring new blood into existing herds. In the illustration, Wells has just slipped from his horse to capture a fine deer by the hind leg.

A RECORD ocean depth of 34,416 feet, more than six and a half miles, has just been discovered by the cruiser *Emden* between Japan and the Dutch East Indies, the German Admiralty announces. The former record was 32,644 feet, off Japan.

Odd Products

Fighting Fire with Soap Suds, Coupe-Motorcycle, Fake Pearl Detector and Other Novelties

Comparison of finger prints is made easier for Los Angeles police by this new device, called a "comparograph." The observer, looking into the hood, sees the two specimen prints, illuminated, enlarged and apparently placed on top of each other. The lines merge if the finger prints are identical, or quickly show up differences in formation

Ultra-violet rays from a new quartz lamp designed for jewelers reveal imitation pearls with startling clearness, making the artificial gems appear shabby by contrast with real ones. The German inventor calls his device the "lucidoscope." It has a special holder to grasp the gems, as shown above

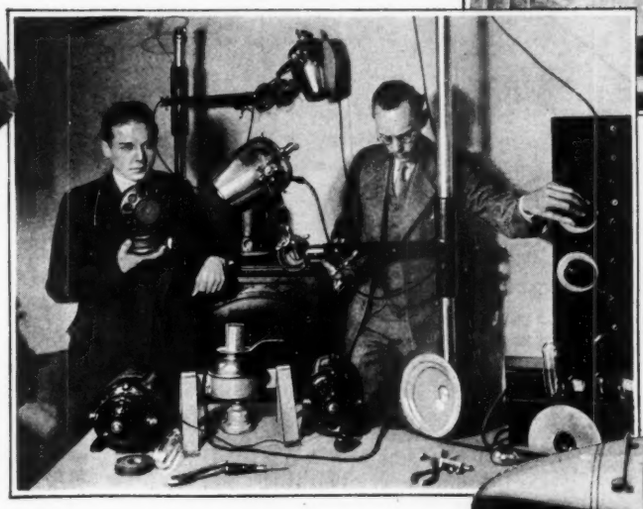
Here's how Harry Dorer, of Newark, N. J., keeps the heat from interfering with summer painting jobs around his house. He attaches a fan to a portable scaffold fastened to his belt, and suspends it over his head so that the breeze blows directly on his face. Current is supplied from an electric socket in the house

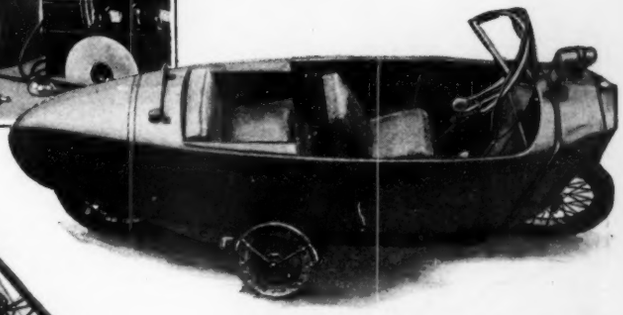
Banking by a chute is the novel convenience provided for after-hour depositors by a Cicero, Ill., bank. The chute is built into the bank walls, and deposits are made from the street as shown at the upper right. In addition to ordinary burglar alarms, the 35-ton vault door has a sensitive sound wave relay device that starts an alarm going at the slightest noise. Even the clapping of hands, as the cashier is demonstrating at the right, sets off the alarm

Red and white lights flashing along the keyboard, instead of notes on a printed page, teach pupils to play the piano in the latest method of teaching. The pupils' keyboard has miniature electric lamps behind its keys, all controlled by the teacher's piano. When she strikes a chord, corresponding lamps light up on the pupils' keyboard. The method is said to be much speedier than the usual laborious way of learning the notes

of Inventive Minds

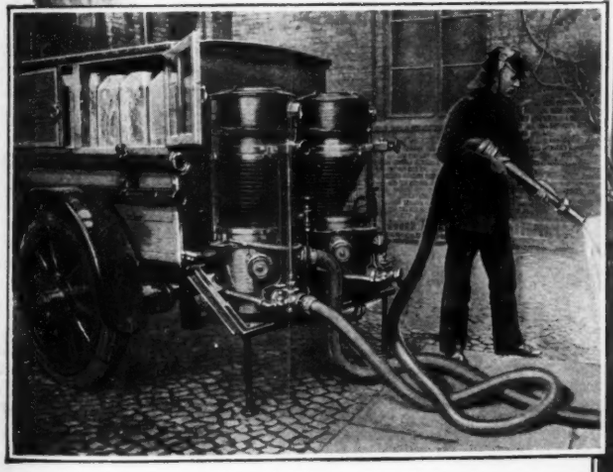
Music has healing powers, believes Huston Ray, concert pianist, and to utilize them he has developed a remarkable apparatus. He takes music from a radio receiver, phonograph, or piano, transforms it first into electrical waves, and then applies the radiations directly to the patient through curious disk-like reflectors. He is shown above giving a demonstration in New York, and at the left with some of his sound wave apparatus





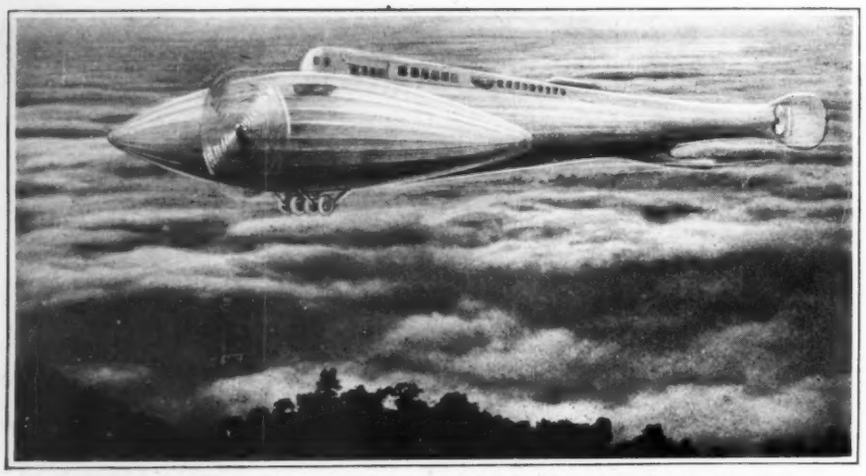
When this vehicle comes to a stop, it has four wheels. Under way, the two small wheels at the sides fold up and the machine becomes a motorcycle. A French inventor's answer to the high cost of gasoline, it is designed to provide automobile comfort for two passengers despite its small size. Foot pedals regulate the motor, while the steering is done with a pair of handlebars

Now the swimmer can wear a belt which, in emergency, becomes a life buoy; or the ocean traveler may wear a life preserver constantly and no one be the wiser. George Waimel, of Kitchener, Ont., Canada, has invented the device, which lies flat against the body, as shown in upper view at left. By a turn of a screw, a glass container within, holding compressed gas, is broken, inflating the belt

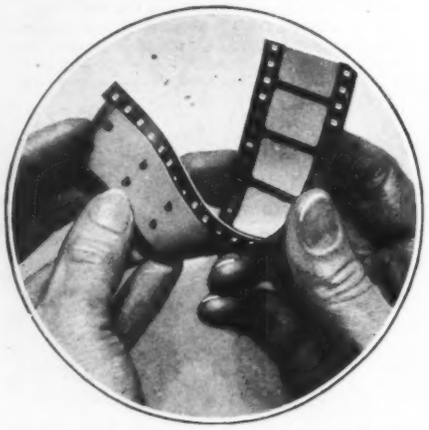


Soap suds are used to fight fires by Germany's latest fire-fighting machine. Particularly useful in smothering gasoline or benzine fires, where streams of water would be useless, this machine carries two large foam generators, filled with powdered soap. High-pressure jets of water race through the soap chamber, operating water wheels that churn the soap into suds, to issue in a foamy blast from the hoze nozzle

Giants all—here we have, in one picture, the biggest crane afloat, the world's largest floating dock (at Southampton, England), and, in the background, the S. S. *Berengaria!* The huge crane bears no resemblance to the conventional boom. It is hinged at one side, and ponderous pistons slide vertically to raise or lower it. Hoisting the heavy machinery of the *Berengaria* is child's play for it



An imaginary picture of the strange aero-ship-plane designed by three New York engineers



Lessens Movie Film Breakage

BACKED with a thin strip of brass, as pictured above, a new movie film passes through the projecting machine with considerably lessened danger of breakage. Holes cut in the metal, instead of in the film, are engaged by the cog-wheels that advance it. Thus the fragile strip is relieved of strain; moreover, the cogs cannot become clogged with shreds of film emulsion, as often happens with standard film. According to the inventor, Arthur Price, of Freeport, N. Y., the new film will be particularly useful for the miniature automatic projectors used in show window advertising, since it will run indefinitely without attention.

Machine Tests Boxer's Punch

A SPARRING partner that can't be knocked out and yet tells accurately the strength behind each punch, is provided boxers in a novel electrical machine, pictured at the right. Perfected in Berlin for testing the punching ability of prize fighters, it substitutes a sturdy and unfeeling electrical apparatus for the body of the boxer's opponent.

Gyroscope for Giant Yacht

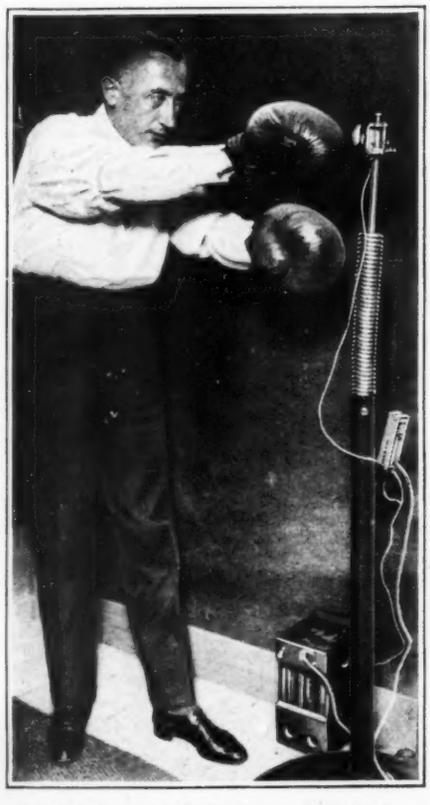
CALLED the world's largest motor yacht, a 294-foot vessel now being built at Wilmington, Delaware, will have a huge gyroscope—a monster replica of a child's balancing top—just forward of the powerful Diesel engines, as an anti-roll device. The spinning twenty-ton wheel is expected to keep the yacht on a steady keel in rough seas.

Our First Ocean Air Liner?

AIRPLANE, ocean liner, and dirigible are rolled into one in an amazing design for the latest proposed trans-Atlantic craft. It is called the "aero-ship-plane" by its inventors, three New York engineers. It is driven by two giant propellers, while helium-filled cubicles and planelike fins support it aloft. If necessary, it could descend to ride upon the waves. Its speed is estimated at ninety miles an hour in the air, and that of a liner in the water.

A hundred and twenty feet long, the craft would accommodate thirty passengers, while a crew of only four men would man the simplified controls. Gyroscopes within the envelope, it is said, will enable the craft to hover motionless in mid-air in stormy weather.

Its inventors hope before many months to complete the first of these strange ships.



Testing his punch. The apparatus records electrically the force behind each blow delivered

Music Sets Off Powerful Explosive

MUSIC-MADE explosions marked an unusual test made upon iodide of nitrogen, one of the most powerful explosives. Known to be more susceptible to some vibration rates than to others, the explosive's critical point was discovered by rubbing some of it on the strings of a bass viol. Each of these strings, the investigators knew, could vibrate only at a certain rate that corresponded to its musical note. One after another the strings were set in vibration by playing the same note on another bass viol in the room. Though nothing happened when the E-string was sounded, the G-string caused a detonation. The vibration rate to which the powder was most sensitive was determined as 60 per second.

"Smell-Meter" to Fight Bugs

AN OLFACTOMETER, or "smell-meter," is the latest instrument devised by the U. S. Bureau of Entomology to aid in its war against injurious insects. By its use the bug and beetle experts hope to find what odors lure certain harmful insects most strongly. From the facts thus learned, powerful artificial scents will be developed that will attract swarms of the pests to places where they can be destroyed.

Don't Listen with Your Eyes

TURN on the radio and shut your eyes, is the advice of the Massachusetts State Board of Optometry. In a simple set of eye-saving rules, it is pointed out that eye muscles and nerves are subjected to a greater strain than any other part of the body. To rest them, as well as to avoid distracting sights, close the eyes when listening to a concert or speaker. And when you read at night, shut your eyes for two minutes at the end of every twenty pages.

Find Mummy in Ohio Cave

AMERICANS need not go to Egypt to dig up archaeological treasures, as witness the find of a party of Boy Scouts near Lancaster, Ohio. In a hidden cave the young explorers came upon a mummy, wrapped in woven reeds. Taken to the Ohio State Archaeological Museum at Lancaster, it was judged by C. H. Shetrone, curator, a discovery of considerable importance. Relics found with it indicated that it was the mummy of an Indian princess.

Tobacco Chemically Made

SYNTHETIC tobacco is the latest "substitute" produced in Germany. Thin sheets of prepared paper are impregnated with chemically made nicotine. Dyed and perfumed to resemble real tobacco, they are then made into cigars.

MINE WORKERS endure the heat in the shafts more easily when salt is added to their drinking water, it has been found. Excessive perspiration causes a loss of salt from the body, and replacing this loss prevents much of the exhaustion that would otherwise result.

NEXT MONTH!

THE epic of the automobile—how, in one amazing quarter-century, we became a nation on wheels, with one auto to every three adults—the struggles, failures, triumphs, of the first makers—all these you'll find in

"Whirling Wheels"

By

EDMUND M. LITTELL

—an absorbing new novel beginning in next month's issue. Both as a picture of the development of the automobile and a fascinating story, you'll enjoy it.

Germans Have Flying Yacht

CAPABLE of flying as well as sailing, an amazing yacht marketed by a German airplane concern can even "taxi" out of the water up on land. Spectators at a recent test saw the crew of the schoonerlike craft transform it into an airplane and fly away. The duralumin masts are demountable for flying, and besides its conventional sails and anchors the yacht has all the necessary aviation instruments. Under the wings are placed removable wheels for climbing to land from the water. All-metal construction minimizes the fire hazard.

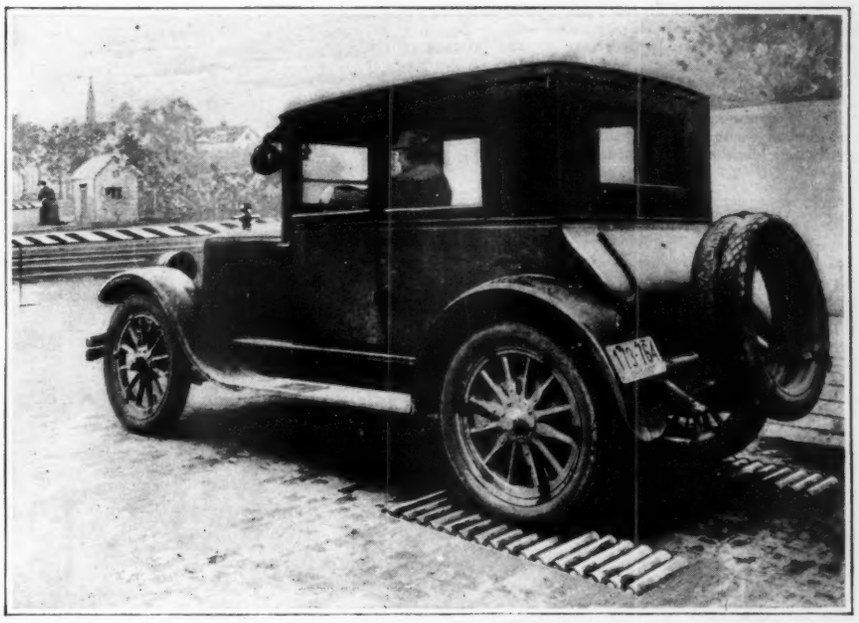
Industry Now Uses Garnet

GARNET, the red stone formerly so popular as a jewel, is today a valuable aid in several industries. For rough grinding, garnet paper somewhat resembling sandpaper is made by coating sheets with broken fragments of the stone. Harder than glass or quartz, it has the added advantage of breaking up irregularly, always leaving sharp edges exposed. Chips of garnet are often used in inexpensive watches as bearings, instead of the sapphires and rubies required in higher-priced timepieces.

Puncture Vine Spreads East

BEWARE of the puncture vine, the sharp-spined burs of which can easily pierce the tread of an automobile tire! Known in California for years, this curious weed has recently spread as far eastward as Illinois, its seeds carried imbedded in the wheels of motor cars. In Kings County, Calif., drastic methods, including spraying the roadsides with oil, have been adopted by Wallace Sullivan, county agent, to eradicate the pest.

ONE DISADVANTAGE of insulin, hailed as a remedy for diabetes, is that it cannot be given in the form of drops, powders or tablets, but must be injected under the skin. Investigators, under Prof. J. C. Minkowski of the University at Breslau, Germany, have produced a substitute for the pancreatic insulin, found effective in a number of cases, which can be given to the patients in capsules.



Test of new device to prevent railroad accidents. The rollers, revolving backward, stop the car

Rollers for Grade Crossings

REVOLVING rollers, spinning backward under a car that tried to ride forward over them, would hold the car practically stationary, though its own wheels might be turning at top speed. This fact is utilized in the latest scheme to prevent accidents at railroad crossings, proposed by Charles Burnett, of Washington Court House, Ohio.

Sunk in the pavement, the rollers would extend all the way across the road (the illustration shows a small model used for testing). By means of an electric control, they could be locked or released.

At the approach of a train, the rollers would automatically be released. Deprived of its tractive power, an auto upon reaching them would come to a stop with its wheels futilely spinning. Not until the passing train tripped the locking switch as it passed out of the danger zone could the car proceed.

The universal adjustment on this vise enables work of awkward or unusual shape to be held upright

"Eraser Key" Aids Typists

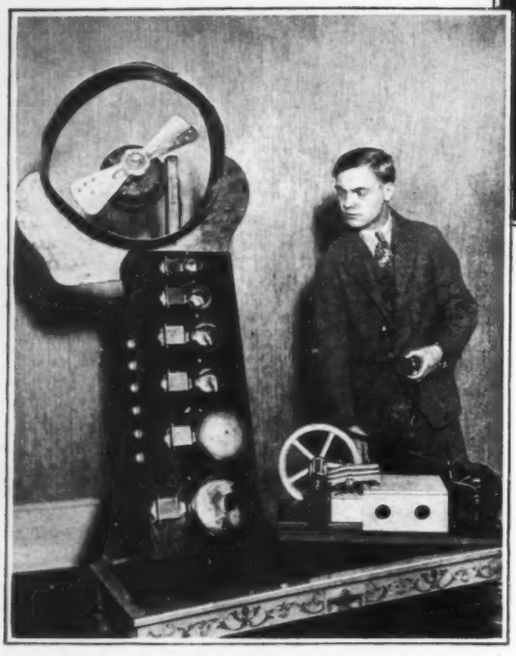
ANY typewriter can now be equipped with an "eraser key" or "eraser lever" which makes the erasing of errors on single copies easy, neat and automatic, according to two Californians who have invented the device. To erase the letter or letters, simply press the lever or key. This thrusts a sharp-edged renewable eraser forward and upward against the platen, to take out one letter at a time. In the picture the eraser key is placed at the right. When attached, the eraser operates as though it were an original part of the machine's mechanism.

Vise Holds at Any Angle

TWIST the vise pictured at the left to any angle you want, says the maker—and it will stay put. Locked with a special lever, it is said to be so rigid that even oil poured over the ball of the universal joint won't make it slip. Another advantage—instead of working in a cramped position, the user can turn the vise to hold the work at the most convenient angle. In the illustration a machinist is using it to hold a metal fork in an upright position while he is working on it. The locking lever is seen just above the metal ball that supports the vise.

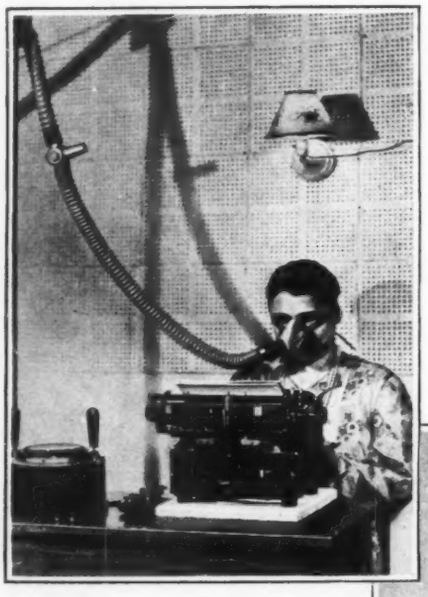
The students pictured at the right can well afford to look serious, for they are—literally—about to take poison! To learn new facts about certain drugs and poisons, Dr. Linn J. Boyd of Flower Hospital, N. Y., recently administered mild doses to fifty volunteers. Their symptoms were then carefully charted. The doses, of course, were harmless, and for purposes of comparison some students unwittingly received pills which contained nothing more than milk and water

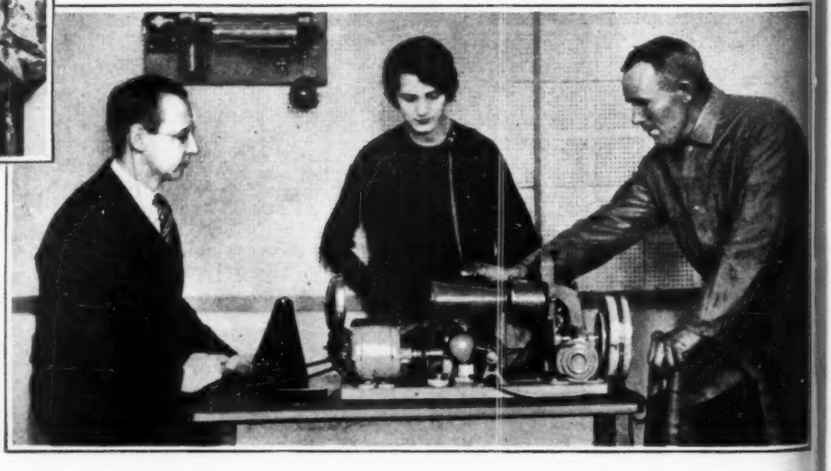
Explorers *of* Science



The "new music" of our mechanical era had its first American hearing not long ago, when George Antheil, composer, startled a New York audience with his "Ballet Mecanique." Antheil's idea is to interpret our industrial age by means of such instruments as electric bells, airplane propellers, auto horns, anvils, torpedoes, screw drivers, police whistles, repeating alarm clocks and so on. The New York audience survived the performance. The young composer is shown above with some of his instruments

When any exploring is to be done in the Arctic, ten to one Capt. Robert A. Bartlett and his schooner, the *Morrissey*, will be called upon. Captain Bob commanded the ship Peary used in 1909 when he reached the North Pole

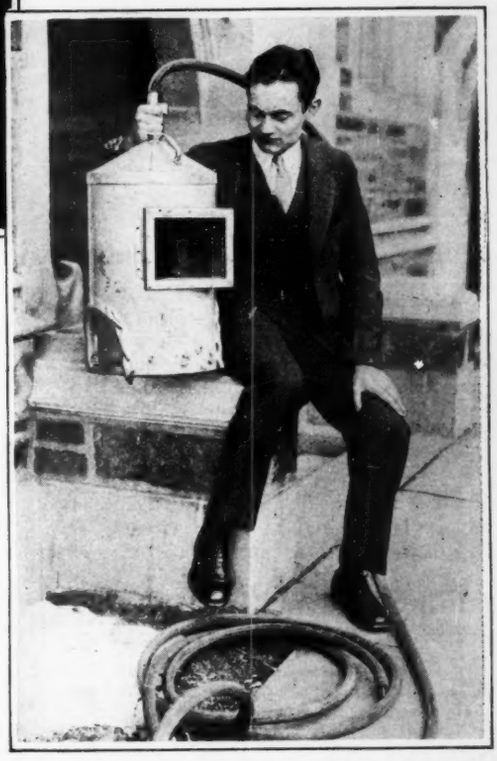




Science can now say definitely that a noisy office makes a typist less efficient. Curious apparatus was used to prove this, in experiments conducted recently by Dr. Donald A. Laird, psychologist, at Colgate University. A noise-making machine (pictured at right) rang bells and produced all the clatter that might conceivably occur in the noisiest of offices. Meanwhile the typist went about her work, while an apparatus like a gas mask (above) analyzed her bodily reactions to the disturbing sounds and measured the wasted energy. In this photograph note the background made up of panels of sugar cane fiber, which, when in place, reduced the noise by fifty percent

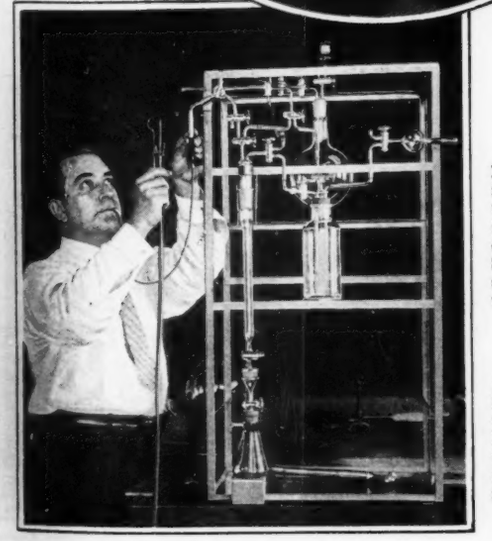
Languages of all races of the world will be preserved on phonograph records for posterity, when a unique collection being made for the new Museum of Languages at the Sorbonne, Paris, is completed. The photo at the left shows a Ukrainian making a record of a song in his native tongue. Careful selection is made of the persons whose voices are recorded, so that the records preserved may be absolutely authentic

Men Who Are Doing the Unusual in New Fields of Experiment—Poisons, Office Noises, Auto Seats, Tested; Recording Languages for Posterity



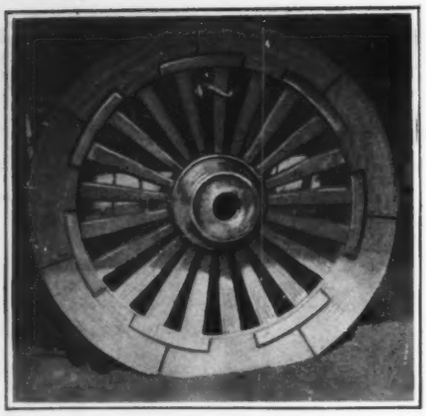
Exploring the ocean's bottom is possible for anyone who can make a diving helmet like the one above, the creation of Carl Breuer, Princeton University student. Breuer tested it out first in a swimming pool, and then took it with him on a trip to Bermuda to collect coral specimens

There's no chance that radio station "2-EB" will interfere with broadcasting programs. Boyd Phelps, of Jamaica, N. Y., rigged up this unique station at his home to transmit signals on the remarkably low wave length of five meters. (Left) Boyd testing the wave lengths of the transmitter in the station at home. (In circle) The portable motor-truck station in which he tours the country to test the range of his signals



Ever wonder how the amazing glass apparatus chemists use was made? Here's how it's done at the U. S. Bureau of Standards, by O. E. Sperling, chief glass blower, shown here shaping the last tube of an intricate device

(Right) Bumpless and slideless auto seats may be devised as a result of tests by Bureau of Standards experts with a unique apparatus that measures jolts that occur in riding over rough highways



Wheel of Seven Sad Sounds

WHEN the late Emperor of Japan was borne to his last resting place, the coffin, in accordance with ancient custom, was carried in a unique hearse with wheels specially constructed to emit the famous "seven melancholy sounds." These are simply seven different creaks, produced in unison at each revolution by the friction of the wooden parts of which the wheels are made. Ingenious joinery is required in the construction. One of the wheels is pictured above.

Falling Meteor Misses Cyclist

WHEN a falling meteor, visible all over England, whizzed through the air like a bluish rocket one night a few weeks ago, one person saw it land. Reginald Harvey was cycling through Oxfordshire when "a ball of fire the size of a coconut" shot past him, whistling, and hit the road twenty feet ahead. Only gray ashes, strewn about the ground, remained of it. As far as known, no meteor ever killed a man; Harvey probably had the narrowest escape on record.

Male Birds Hatch Eggs

THE males keep house among the rare Arctic surf birds, recent discoveries have revealed. Though this bird has been known to science for 150 years, the first nest and eggs were found only recently on Mt. McKinley, Alaska. From the bird's breeding habits, it is now known that not only does the father bird hatch the eggs, but he defends them far more valiantly than does the female.

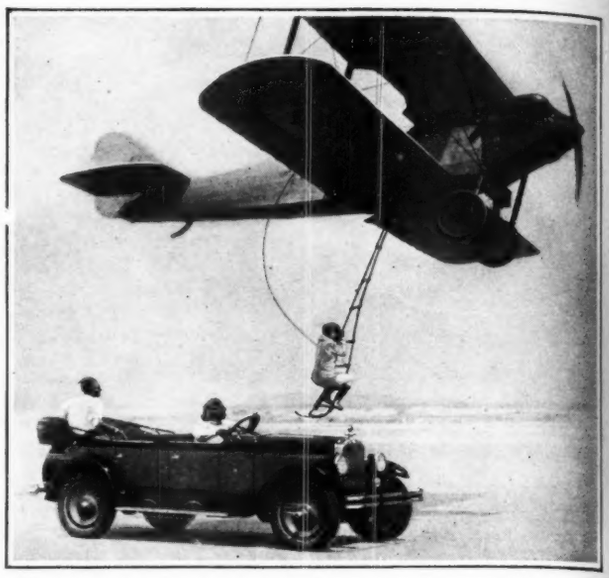
Are You Planning to Buy an Oil Burner?

AS A result of its investigation of 3,343 oil burner installations, the Popular Science Institute of Standards is prepared to assist readers planning to install this type of heating equipment. Advice on selection and installation to meet your needs will be sent, providing the following information is supplied: (a) Number of rooms in house; (b) Type of heating system; (c) Annual coal consumption; (d) Gas or electricity installed.

No charge will be made for this service. Address your letter: Oil Burner Service, Popular Science Institute, 250 Fourth Avenue, New York City.

Girl Daredevil Rivals Men

SWINGING clear of a speeding automobile as she grasped the perilous rope ladder suspended from a plane above, Mabel Cody, girl daredevil, made spectators at Daytona Beach, Fla., gasp the other day as she performed the feat pictured at the right. Both car and plane were whizzing over the sand at something like a mile-a-minute clip at the moment Miss Cody made her hazardous hop. The ladder was pulled in by a hanging rope from above.



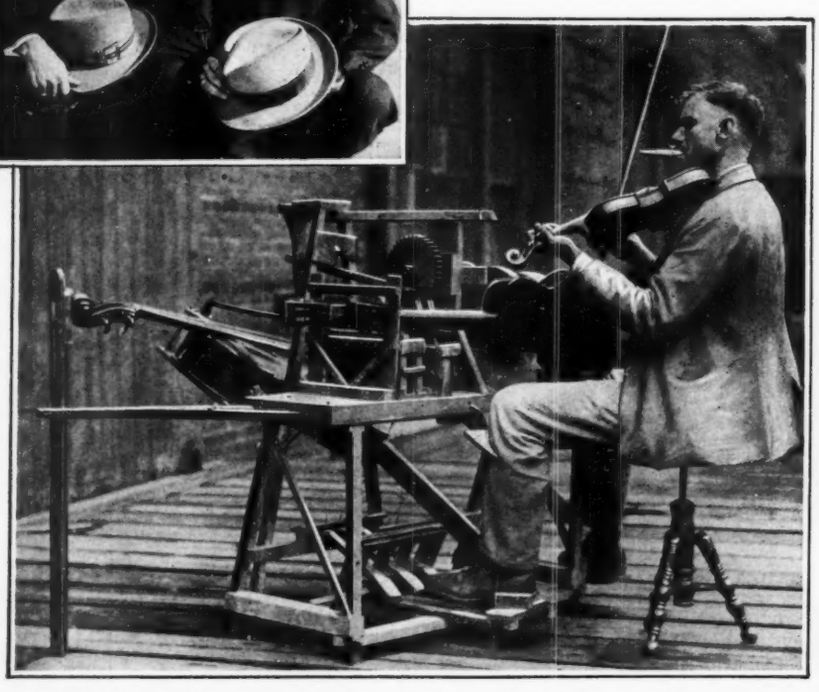
You Can't Tell 'Em Apart

THOUGH appearances are against it, the remarkable photograph at the left is not a trick picture. It was made at the first meeting of the Twin Brothers Club in Los Angeles, Calif. Only men who look alike are eligible for membership. These four sets of twins passed the entrance tests with flying colors.

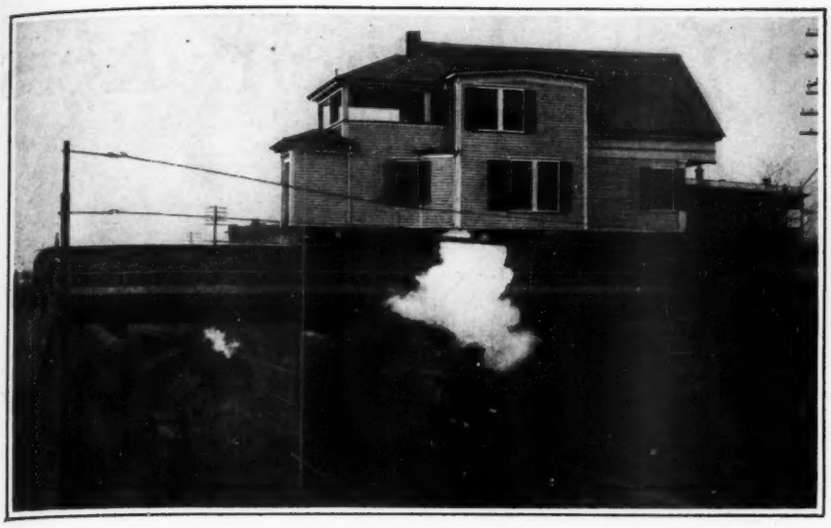
Six Instruments in One

HIS own orchestra and orchestra leader at the same time, S. L. Norris of Dalton, Ga., has invented a remarkable device that enables him to play a fiddle, a guitar, and a 'cello all at the same time—and a whistle, banjo, and set of bells besides, making a total of six pieces in all.

Foot pedals and strange gears are features of his ingenious invention which was recently exhibited at a fiddlers' convention in Atlanta. The photograph below shows it in operation.



When a fiddler combines mechanical ingenuity with musical ability, something unusual is bound to result. Here is S. L. Norris, of Georgia, with his one-man, six-piece orchestra



Sixteen-Ton Bridge Holds Sixty-Ton House

WHEN moving day came around for the owner of the large frame house pictured above, in West Newton, Mass., he decided to take his house with him over the railroad bridge to the other side of the tracks. The photograph shows how the remarkable engineering feat was accomplished. Though the bridge was rated for a load of only sixteen tons, heavy timbers supported it safely during the moving of the sixty-ton dwelling. Telephone and telegraph wires were cut in order to allow the house to pass.

A Diamond Rush in Action

AS DIAMOND rushing is staged today, it's length of leg that counts, and the winners win by seconds. When British government officials gave the signal that started the latest South Africa rush to stake diamond claims at the Grasfontein farm, a remarkable scene, pictured below, was enacted. As though shot from a bow, thousands of bare-legged fortune-hunters dashed across the veldt to seize the best spots of the world's richest diamond field. Men, women and children, they had been waiting for weeks for this moment. The photograph shows them just after the start. Many large diamond companies hired professional runners to race ahead and secure the finest claims. A vivid picture of a modern diamond rush was drawn by Edgar C. Wheeler in the March POPULAR SCIENCE MONTHLY in his article, "Crystals of Fire."

Blood 1-20th of Man's Weight

WHEN a man gives a quart of blood for a transfusion, he parts with more than a fourth of his entire life stream, recent tests have shown. The average healthy man possesses an amount of blood equal to 4.9 percent, or about one twentieth of his total weight; for example, if you weigh 160 pounds, you have about eight pounds of blood—a little less than four quarts.

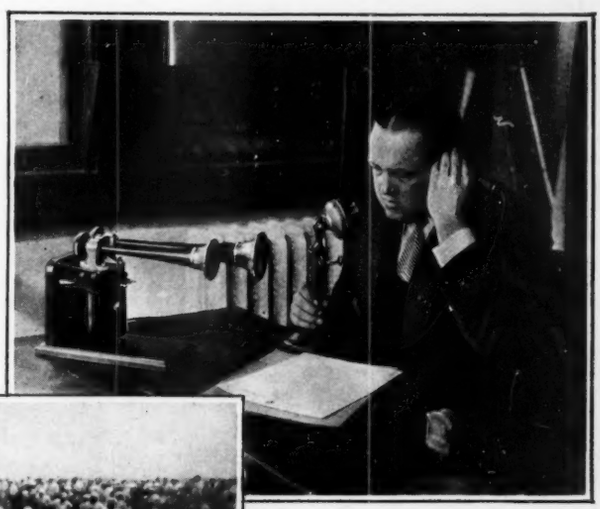
The quantity of blood was determined by injecting dye into each subject's circulation. Three minutes later, samples of the blood were taken. The extent to which the dye had been diluted showed the amount of blood possessed.

Doll's House in Match Box

LIGHT housekeeping on a small scale goes on in this tiny doll's house, constructed in a match box. The designer of the minute apartments, Charles W. Aldridge, of Battersea, England, spent thirty-five hours "building" it, and making a doll small enough to be the occupant. A masterpiece of tinycraft, it is completely furnished, even to pictures on the walls and a covering on the table.

New Depths for Oil Wells

MORE than 8,000 feet deep and still going down, a California oil well is already the deepest well in the world. Advances in rotary drilling machinery have made possible many recent depth records, and wells two or three miles deep are predicted for the near future.



Racing for diamonds! This is what the recent South Africa diamond rush at Grasfontein actually looked like after the starting signal was given. Each participant carries pegs with which to stake out his claim

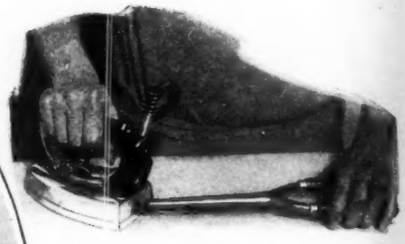
U. S. Phones England a Sample Toot

AMONG the first novel uses made of the new trans-Atlantic telephone between the United States and England was that by an enterprising middle-western manufacturer of automobile horns. To close a sale in London, he mounted his new two-tone horn near the phone, as seen in the illustration above, and sent a sample toot across the Atlantic. The musical sound was clearly heard by the customer four thousand miles away.

Handy Aids *for* Homemakers

Spear a potato with this remarkable fork, hold it over a plate, and presto! the hot potato is pushed off automatically. Meat, cake, or waffles are also served more handily with this convenient new device

In a new handy set of scientifically-made instruments for candy making are a special candy thermometer to control the temperature of the mix and keep it from burning; a "sugar meter" that measures the sweetness of the syrup; and an oven thermometer. Another useful new device, which this housewife is holding in her left hand, is a low-temperature thermometer for the home refrigerator

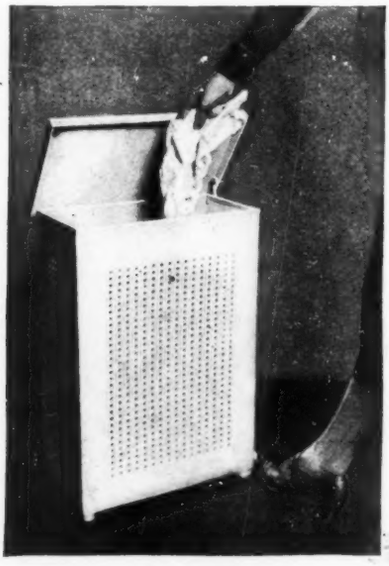


Especially designed for travelers is this electric iron, with its detachable handle that can be clipped in place by a spring or packed separately in a small space. High and low heats are provided by reversing the position of the connecting plug. In the base of the iron is a hole in which a curling iron may be inserted as shown above

Here's the modern way to boil rice—in an aluminum ball with holes in the sides, like a huge tea ball, which unhinges to let cooked food drop out

Gas heat is saved by an ingenious metal ring that fits over any burner of the gas range. It prevents the outer gas flame from spreading in all directions, concentrating it directly under the utensil to be heated. Not only is waste eliminated, it is said, when the novel device is used, but cooking is more rapid

A new egg beater is shaped especially to fit in an ordinary coffee cup or glass tumbler, to avoid waste when, for instance, only a single egg is to be beaten. Adaptable, of course, to larger bowls, too, it makes a serviceable all-around utensil for the kitchen



The clothes hamper, like the sanitary kitchen garbage can, is now improved by the addition of a handy foot pedal arrangement, pictured above. Press your foot on the pedal and the lid flies up. This model has perforated metal sides, for thorough ventilation, and is patterned to resemble rattan

Here's another modern improvement for the cake pan! A mica window in this pan makes it possible to watch how the baking is progressing without taking the pan from the top of the stove or even removing the heat-retaining lid. A small hole is also provided, through which the cook can insert a straw to find out if the cake is done

Juice won't spill over the edge of this new pie plate. Beyond the place where the rim of the ordinary pie plate usually ends is another wide outer rim, to keep the liquid in and so retain the flavor in the pie

Electric Table Fan, Rice Boiler, Novel Clothes Hamper, Dishwasher and Other New Devices Lighten Housework

With a hole in its cover for the razor handle, as shown above, a new bath for razor blades is said to keep them free from rust, and even to remove invisible particles of rust in new blades. The container is so designed that the blade itself does not come in contact with any hard substance, but hangs from the handle

Unique in shape, the new electric dishwasher above uses whirling sprays of water within its domelike hood to clean the dishes. An electric motor concealed in the base spins the jets; and rubber connections lead the water from faucet to washer and back to the sink. The nineteen-inch wire basket within the hinged cover holds all after-dinner dishes, including silver, of an average family

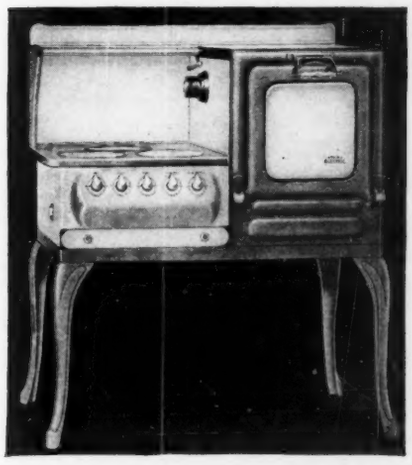
Here's a device that cuts the doughnut and puts the hole in besides. In skilled hands it disposes of a mass of dough with amazing speed, whirling out doughnuts as it goes. A snap of the wire holder, and the tool comes apart for cleaning, without the removal of screws, as demonstrated in the upper picture

Five times as fast, it is said, as you can beat eggs or batter by hand, this motorized Dover beater does it for you. Its cord plugs into the wall socket, and a switch at the side of the sturdy motor varies its speed

This iron stand performs the additional duty of saving current and preventing the electric iron from overheating. If the housewife is called away to the telephone or other duties while ironing, replacing the iron on its stand automatically shuts off the current

An electric fan that rests horizontally on the table, can be picked up by a handle, and plugs into any socket like a portable lamp, is an interesting novelty. Its strong upward breeze maintains the surrounding air in circulation without creating dangerous drafts or blowing directly upon persons near by, according to the maker. A guard protects fingers from the whirling blades

Open one leg of this bridge table and the rest unfold automatically, at the same time! Ingenious levers connect them so that they work together and snap locked when open. Folding in one leg causes the others to follow



With completely automatic time and temperature control, a new electric range may be set to cook for any desired time, at whatever temperature you wish. Five switches along the front control the heat of the three cooking plates and the oven top and bottom, giving three degrees of heat as needed

Hints for Radio Beginners

How to Choose Condensers

Capacity and Voltage Determine the Type of Construction

BEGINNERS in radio often become completely bewildered on the subject of condensers. The trouble is that too many names are applied to exactly the same article. For instance, the terms grid condenser, bridging condenser, stopping condenser, by-pass condenser, plate condenser, filter condenser, all refer to a plain, ordinary fixed condenser of whatever capacity is required at that particular point in the radio circuit.

In fact, there is no difference, from an electrical point of view, between the two condensers shown in the photograph on this page except that the small one is of fixed capacity and the larger one can be adjusted to any capacity from a very low minimum up to the maximum obtainable when the movable plates are fully engaged with the stationary ones. Both are of .00025 microfarad capacity, and while the larger condenser ordinarily is used as a tuning condenser because of the variable capacity feature, it could be used in place of the small fixed condenser with identical results.

All condensers, no matter by what high sounding name they are called, consist, essentially, of some metal plates separated by air, mica, paper or other nonconductor. And, assuming that the condenser is made of high grade materials, it has only two qualifications that are important to the user. You will want to know its capacity in microfarads and the voltage it will stand in continuous duty without breaking down.

Its ratings on these two points determine the type of construction that will prove most economical, and have an important bearing on the size of the finished article. The capacity of any condenser is determined by the area of the plates, the distance between them, and the material used as insulation. The voltage is determined by the spacing of the plates if air is the insulator, and by the thickness of the insulation when paper or some other material is used.

The higher the capacity, the greater the area of the plates and the higher the voltage, the more insulation must be used. That is why fixed condensers vary in size in proportion to the capacity and working voltage.

These two condensers are electrically the same. The difference is, the larger one is adjustable

While the water supply pipe is the best ground for radio, pipe driven in the soil will give good results if you sink it far enough in a damp place

Be Sure to Have a Good Ground

POOR reception frequently is due to an unsatisfactory ground connection. Sometimes a poor ground connection will show up in the form of generally weak reception, particularly on distant stations; and occasionally a poor ground is the cause of broad tuning and lack of selectivity. Testing the effectiveness of a ground connection with scientific accuracy is outside the range of amateur work, but it is not difficult to determine in a rough way whether the ground is good enough. With a poor ground connection, you will find that removing the ground wire from the receiver makes almost no difference in the strength with which local stations are received; and on the rare occasions when distant stations are tuned-in with good volume, disconnecting the ground may result in only a slight decrease in signal strength.

You can be sure that if connecting or disconnecting your ground makes little difference in reception results, your ground connection is not as good as it should be.

Under ordinary conditions, the best possible ground for radio purposes is a wire properly clamped to the water supply pipe as near as possible to the point where it enters the building. The next best ground is a connection to the cold water pipe somewhere upstairs. And if you can't do that, connect to any available point on the cold or hot water piping or to the steam or hot water radiator. The trouble with connections made to any point on the piping upstairs is that the joints in the piping may produce rather high resistance because of the pipe compound used in them.

Don't use the gas piping as a ground. In the first place, this is forbidden by the rules governing your fire insurance; in the second place, the gas pipe is a poor ground anyway. In most installations, there is an insulating bushing in the pipe somewhere near the meter.

When no water supply pipe is available, the radio fan must construct his own ground. The simplest way is to drive a pipe at least three feet down into damp ground. Merely driving a short length of pipe into sun-baked top soil will not give you a good ground. It is absolutely necessary to get down to damp earth.

When there is doubt about the condition of the soil, it will prove worthwhile to bury several square feet of metal as deeply as possible after making a solid connection to the metal with a heavy piece of copper wire, such as No. 6 or No. 4. Sheet copper can be used, but equally good results can be obtained from any old metal wash boiler or ash can. It also is a good idea, in dry weather, to pour water on the ground.

A B C's of RADIO

IF YOU find it necessary to save every possible penny in buying parts for a radio set that you expect to build, divide your money so that at least the important parts will be as high-grade as possible. For instance, the tone quality and consequently your enjoyment of the set will depend entirely on the quality of the audio transformers in the audio amplifying end of the set. Save money elsewhere if you must, but be sure to get modern, high-grade audio transformers.

You can buy cheap variable condensers and they will work reasonably well, at least for a while. The same may be said of tube sockets. Winding your own tuning coils is one way of saving money that doesn't entail any reduction in the efficiency of the finished set, provided you do a careful and workmanlike job. So little can be saved by purchasing low-grade fixed condensers, grid leaks and other small parts that it is not worth while to get anything but the best. A plain piece of dry wood will serve as a panel until you can afford a bakelite or rubber one.

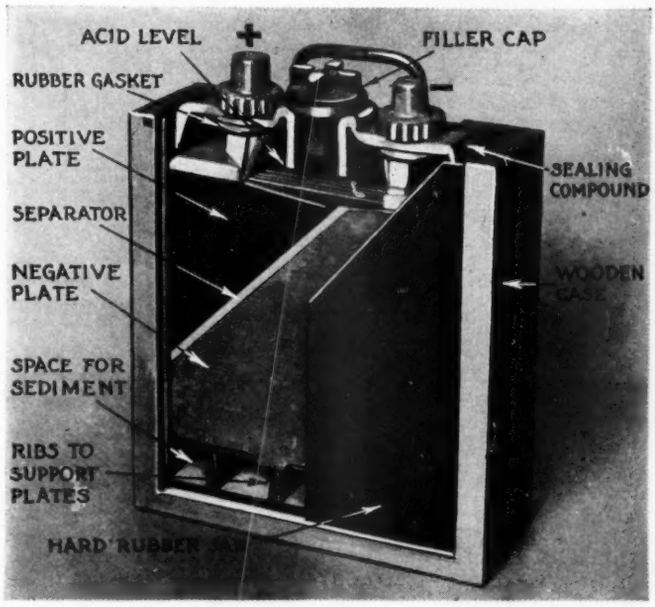
In short, have the important parts as high-grade as you can and save by constructing many of the simpler items, including the cabinet. Basically your set will be good. Later on you can add parts to complete a high-grade outfit.

Perfect A-Current *for Your* Radio

A Storage Battery Will Supply It—Hints on Charging, Installation and Care That Will Insure Best Results

By ALFRED P. LANE

IN SOME respects the storage battery that you use to heat the vacuum tube filaments in your radio set is a unique piece of apparatus. It is capable of supplying an absolutely smooth flow of current without a trace of fluctuation. No other commercially practical piece of apparatus is in a class with it in this respect. In fact, laboratories devoted to scientific research depend entirely on storage batteries when they need perfect direct current—in experiments, for instance, where the slightest tremor or irregularity would spoil everything. Even on high direct current voltages this holds good, so that storage batteries consisting of hundreds of cells now are a standard part of the equipment of any good laboratory.



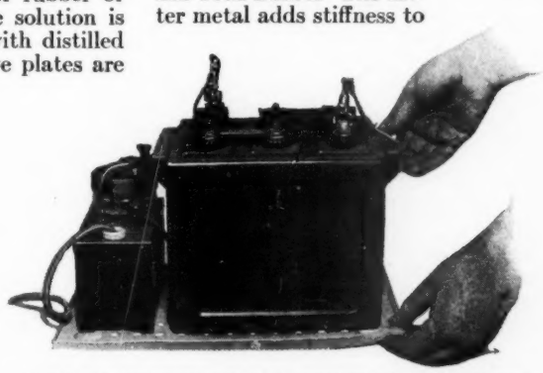
All lead acid storage batteries are built this way with minor variations, depending on the capacity and the service for which the battery is designed

You can be sure, therefore, that if your storage battery is in reasonably good condition, it will give you a perfectly noiseless flow of current through your vacuum tubes. You may hear various noises coming out of the loudspeaker, but you can rest assured that they are *never* caused by the storage A-battery.

But a storage battery, like any other man-made device, can break down and cease to function properly. In order to prevent that unpleasant possibility, you must give your battery proper care. Knowing what takes place inside the battery will help you do it.

THE illustration on this page gives a good idea of how all lead acid storage batteries are constructed. Essentially, they consist of an acid-proof rubber or glass jar for each cell. The solution is pure sulphuric acid mixed with distilled water. Positive and negative plates are placed close to each other with separators between to insulate them. The number and size of the plates determine the capacity of the battery. All the positive plates are connected to one terminal of the cell and the negative plates to the other. Then the individual cells are connected in series by lead strips burned on to the terminals. Since each individual cell develops approximately two volts regardless of the size or number of plates, the total voltage of the battery is the sum of the voltages developed by the individual cells. That is why a small capacity battery runs a six or eight tube radio set just as well as any larger size.

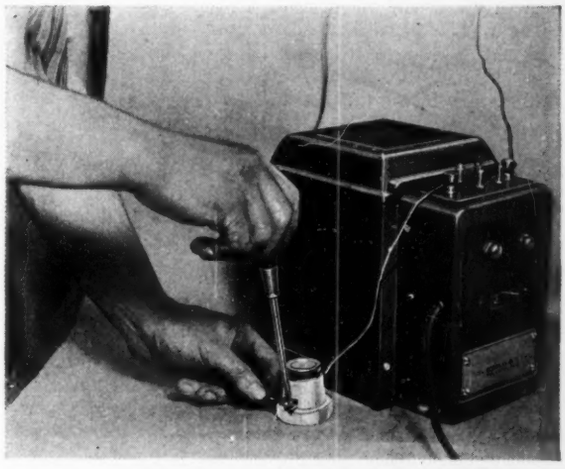
Both positive and negative plates are made from grids cast out of lead to which a little antimony has been added. The latter metal adds stiffness to the plates and helps to prevent them from buckling. Lead peroxide is pasted into the openings in the positive grids while the negative plates are pasted with litharge. During manufacture, the plates are subjected to tremendous pressure to make sure that the material will stay in the openings in the grids.



Modern batteries are so carefully constructed that the chance of an acid leak is remote. A rubber mat or a large glass tray put under the battery can be used for extra protection

The storage battery actually does not *store* electricity. It is a storehouse of chemical energy that is capable of producing electricity. The process is reversible so that after the chemical energy is all used up, a current of electricity can be passed through the cell in the opposite direction to restore the plates to their original condition.

When a metallic circuit is made between the positive and negative terminals of a storage battery, current flows through this circuit. The chemical action required to produce the electricity causes lead sulphate to form in both positive and negative plates. This action also reduces the amount of sulphuric acid in the solution. Reversing the action—that is, forcing current through the battery from some outside source—changes the sulphate back to lead peroxide and litharge or sponge lead and increases the amount of sulphuric acid in the solution. Consequently the amount of acid in the solution at any given time is an accurate index of the state of charge of the battery.



Be sure to use a fuse in one of the wires leading to your storage battery. It will prevent the possibility of a fire from a short-circuited wire

Sulphuric acid is much heavier than water, so that, as the acid goes out of the solution into the plates during discharge, the weight of the solution becomes less and less and a hydrometer floating in the solution would sink lower and lower.

However, the lead sulphate takes up more space than the material from which it is formed, and if the battery is discharged too far, this sulphate will clog up the pores of the plates and swell and buckle them. And if the battery is allowed to stand in a discharged condition, the sulphate becomes hardened in such a way that subsequent charging does not reduce it and the battery is permanently injured or, perhaps, completely ruined.

Storage batteries are rated according to the number of ampere hours of electric current they can supply on one charge. An ampere hour means a current of one ampere flowing for one hour. For low rates of current consumption, as in radio A-battery use, it is easy to compute approximately how long a battery of a certain size will run any particular radio set. Just divide the ampere hour capacity of the battery by the rate of current consumption of the set and the result is the number of hours the set will run before the battery needs recharging. If, for example, a set takes one ampere of current and is connected to a sixty-ampere hour battery, you will get sixty hours of use on a charge. If the set takes two amperes the battery will run it for thirty hours, and so on.

Although a storage battery supplies perfectly smooth direct current, it is not necessary to have a uniform flow to recharge it as long as the pulsating current flows in one direction and the average rate of flow is within correct limits.

NO STORAGE battery should be charged at a higher rate than is needed to give it a complete charge in eight hours, and it is better to use a rate that will fully charge the battery in about sixteen hours' time. Much lower rates than this can be used with good results, and consequently trickle chargers with a half-ampere rate are coming into use very rapidly.

A storage battery is like an automobile tire in that its length of life is well defined. You can bank on a high-grade tire's lasting for from ten to fifteen thousand miles; if your storage battery gets the proper care you can be assured of from four to six years of satisfactory service. In time the active material in the plates falls away and settles in the space provided at the bottom of the jar. Eventually the space is all filled up with the active material that is dislodged from the plates, they are short-circuited by the piled-up sediment, and the life of the battery is ended. The amount of space allowed below the plates in the battery always is made large enough so that by the time the short circuit occurs, the plates are practically worn out anyway.

But a huge percentage of batteries used for radio work never live to a ripe old age. Abuse and neglect cut them off in what ought to be the prime of life.

Insufficient charging is the most prevalent form of abuse. Allowing the battery to stand discharged comes next. In either case the result is the same: the active material in the plates turns into hard sulphate.

THE storage battery is a long-suffering piece of apparatus. It will keep delivering current like a game fighter under conditions that are ruinous, and then it will suddenly throw up the sponge when you least expect it. Unfortunately, too, storage batteries stand mistreatment without showing signs of distress. It would be better if the battery turned bright red or set up a tremendous noise at the first sign of mistreatment, to warn the radio fan that something was wrong.

Any good storage battery will keep the tubes in your set lighted for many hours after it has passed the danger line of chemical exhaustion and the point where injurious sulphation starts. This means that you must not keep on using the battery until the tubes go out. And if you do happen to run the battery down to complete discharge by accident, waste no time in connecting up your charger and giving the battery a full charge, with a couple of hours overcharge for good measure.

One peculiarity of the lead acid storage battery is that it doesn't charge properly if it is exhausted and the charging rate is too low. Radio fans have found themselves in trouble on this account without knowing what was wrong. The maximum and minimum charging rates depend on the surface area of the battery plates. You can apply a half-ampere charging rate from a trickle charger to a small battery, say one having a thirty ampere hour capacity, which will gradually bring it up to full charge even if it is down to the limit of safe discharge. But you may have trouble if you use the same rate on a battery of 120 to 150 ampere hours. The trickle charger will keep the big battery charged once it is brought to that condition by charging at a higher rate, but even then, the big battery is not so desirable because a greater percentage of the charging current is wasted in replacing the internal losses, which are in proportion to the size of the battery.

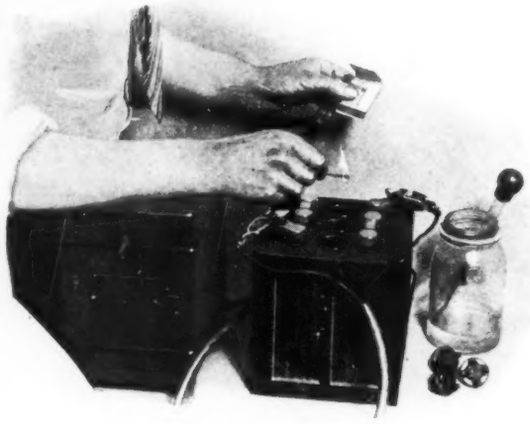
That is one of the reasons why it actually is better to buy a small battery rather than a large one if you expect to use a trickle charger. And if you are going to keep the battery charged at all times, there is no need for the larger and more expensive battery anyway.

Keeping your battery charged is your first consideration, but care in other directions is necessary also.

Be sure to place the battery where it is easy to get at. Then when it becomes necessary to add water or test it, you will not shirk the job because of the trouble.

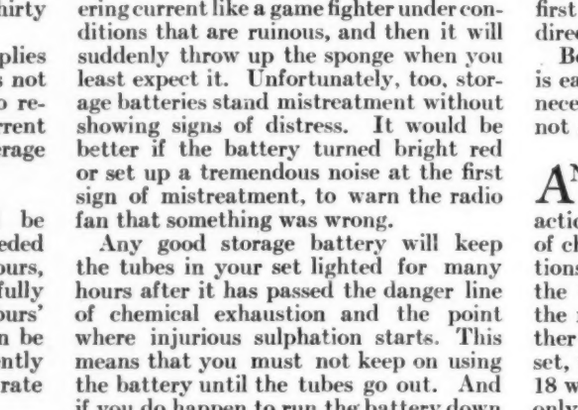
AND remember that while noises from the loudspeaker never come from any action inside the battery, there is plenty of chance for trouble with poor connections in the wiring. Make sure that the wires from the storage A-battery to the radio set are of ample size. The farther away the battery is from the radio set, the larger should be the wires. No. 18 wire is large enough if the battery is only a foot or two from the set, but if you have the battery in the cellar or a near-by closet, use No. 12 wire. Whatever size wire you use, pay particular attention to the binding posts. See that they are firmly clamped on the wire and that the bared end of the wire is clean and free from corrosion. This is most likely to occur on the binding posts at the battery, so it is a good plan to inspect these connections every few months or at the first sign of noisy reception that isn't caused by static in the air.

Wiping off the top of the battery and the binding posts with a rag moistened with ammonia is a good way to forestall corrosion. After you have the top of the battery cleaned, go over all the exposed lead parts with a vaseline-covered rag. Corroded terminals and a (*Continued on page 130*)



Don't Do This!

HYDROGEN and oxygen are produced in the storage battery, especially while it is being charged. These gases individually are colorless, odorless and harmless, but when mixed together in the space above the solution in the battery, they will explode with great violence if ignited by a spark or the flame from a match. If you want to inspect the level of the solution, use an electric flashlight—*Don't use a match!*



A good way to forestall corrosion is to clean the terminals and the top of your battery every few months with a rag moistened with ammonia and then smear a thin coat of vaseline on the terminals

You *Need* a Lightning Arrester

How One Man Nearly Burned Down His House Before He Learned the Importance of This Radio Protective Device

As Told to
NEWTON BURKE

I NEARLY burned down my house just to save a dollar! And even if I was lucky enough to avoid a serious fire, saving that dollar cost me a new pair of window curtains and a painter's bill for touching up the woodwork where the flames had scorched.

Doing odd jobs around the house is one of my chief amusements; so when my wife and I decided that it was about time to get a radio, I shopped around a bit to buy an outfit. We had settled on the amount we could afford to pay, and it took some careful figuring to stay within the limit. I picked out a set and a loudspeaker and batteries and tubes, and after that there was just enough left to get some antenna wire and insulators. The dealer tried to sell me a lightning arrester, but the extra dollar for that would have pushed the total beyond the top limit; so I decided to get along without it.

There was a table near our living room window that made a fine place for the radio. I strung the antenna wire from a pole on the roof to another one on the garage, with an insulator at each end. I brought the end of the wire down to a binding post on one of those flat strips of insulated metal designed to be placed across the window sill so that you can shut the window down on it. The other end of the lead-in insulator I connected to the antenna binding post of the set. The radiator in front of the window turned out to be a good enough ground for ordinary use.

The set worked fine for several months, until one spring evening, when I was reading the paper and not paying much attention to the broadcasting.

"Harry," said my wife, "what is the matter with the radio? Don't you hear all those snapping and scratching noises?"

"PROBABLY the batteries running down," I replied absently, and went on with the paper. A moment later—

"Oh, Harry! Quick, look! It's on fire!" she shrieked.

I dropped the newspaper and jumped up just in time to see angry red flames licking their way up the curtain behind the radio set. My wife already had grabbed a flower vase full of water and started for the window.

I looked around excitedly for another vase, snatched up the goldfish bowl, and if my wife hadn't succeeded in putting out the flames with the water in the vase, we'd have had to buy a couple of new goldfish besides paying for the rest of the damage.

"If my wife hadn't put out the flames with the water in the vase, we'd have had to buy new goldfish besides paying for the rest of the damage!"

There was a real storm going on outside by the time we had cleaned up the mess, and the flashes of lightning gave me a clue to what had happened. In fact, a severe shock in the arm when I grasped the antenna lead-in would have been evidence enough for anybody.

The wire to the antenna binding post on the radio set had been tight when I first put it in, but the table had been pushed back to the wall and the wire sagged so that it was only a fraction of an inch from the radiator. I recalled how Benjamin Franklin had drawn sparks from a string of a kite flying during a thunderstorm, and I figured that my antenna had acted like Franklin's kite string. The sudden surges of electricity induced by the electrical storm must have flashed across the small space between the antenna lead-in and the iron of the radiator. The edge of the curtain must have been in the path of the spark.

It seemed funny to me that the electric current should have chosen a high-resistance path across the air rather than the solid metal path offered by the coils in the radio set, but you never can be quite sure of what a high-frequency discharge is going to do. It generally takes the shortest path if the longer path has many twists and turns in it, such as the coils in the radio set.

To prevent further trouble while the storm continued, I disconnected the wire from the antenna binding post and wound the bare end of it around the radiator valve. The next day I stopped in at the radio dealer's store and told him about our near-catastrophe.

"It's a lucky thing you were there when it happened," he commented, "or your house probably would have burned down. The fact that the radio would have been turned off if you had been out, wouldn't have helped matters any. And what's more, you wouldn't stand a ghost of a show of collecting any money from the fire insurance company, because you were violating one of the clauses of your policy by using a radio set without a protective device or, in other words, a lightning arrester."

He brought out several different makes that had been approved by the Fire Underwriters.

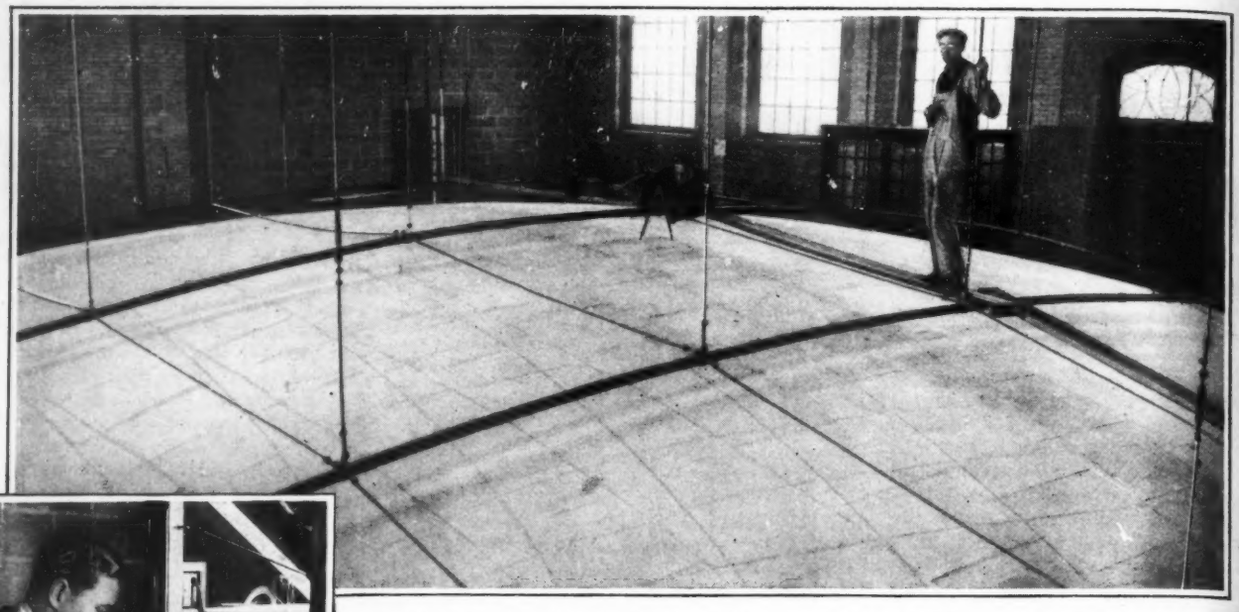
"How do you install one of these lightning arresters?" I asked.

"That's an easy matter," he replied. "Just fasten it with these screws to the woodwork right outside the window. Connect a piece of wire from one binding post on the lightning arrester and join it to the nearest point on the antenna lead-in. Then run another wire from the other binding post on the arrester down the side of the house on insulators and connect with a ground clamp to a three-foot piece of pipe driven into the ground.

"IF YOU find that you can't drive a pipe into the ground at that point, you can run the wire through the cellar window and connect with a ground clamp to the nearest point on the cold-water pipe."

"You can wrap up one of those right now," I said. "I should have taken your advice in the first place."

Building Largest Map *a* Giant Task



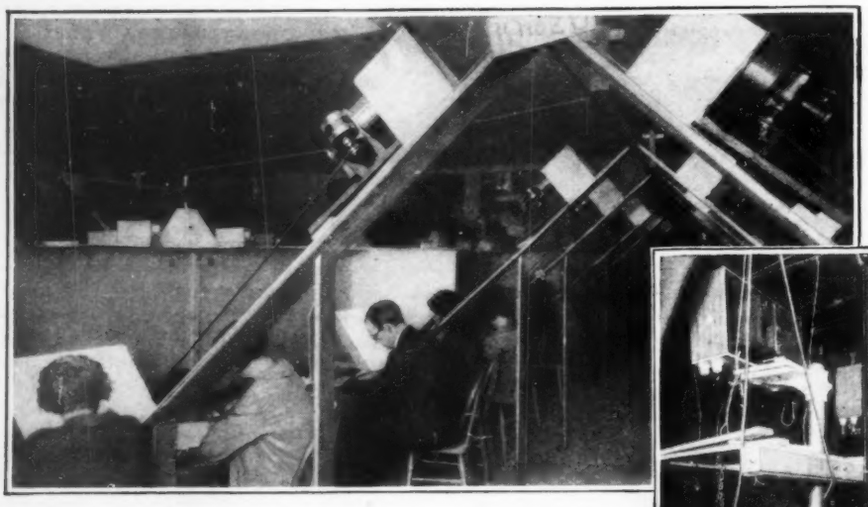
Preparing on a jigsaw one of the cardboard layers which, cemented together, give the proper elevations of mountains and valleys to the plaster block

CAN you imagine yourself studying a map sixty-three feet from east to west and forty-six feet north to south? Such are the dimensions of the largest map of its kind in existence, now in construction at the Babson Institute, Wellesly Hills, Mass. So huge is it that it covers the floor of an entire hall. Its scale is four miles to the inch, so you can almost find your home on it! When completed, it will be used for study and for photographic purposes.

The map will be a relief map of the United States and Canada, with mountains raised, plains leveled and valleys sunk to correct scale. Its most unusual feature is its curved surface, suggesting vividly the spherical nature of the earth.

At present the foundation is practically re[illegible]s pictured above. Over this, piece by piece, will be fitted the relief work, in plaster blocks molded to show the surface characteristics of a square section of country. The measurements for this painstaking job are all based on maps made by the Government.

Movies Preserve County Records



ONE of the strangest movies ever made was recently staged in Seattle, Wash., when more than a thousand motion picture reels were used to film the county records—the first feat of its kind in the world.

A Seattle title concern was faced with the gigantic task of classifying two million records of real estate transactions stored away in the county vaults. The job would have taken four years and involved endless files of information cards. Instead, the "movies" were used.

(Above) Projecting machines threw pictures of the records on a screen, page by page, from which clerks compiled their information for cross-indexing. (Right) The records were filmed with movie cameras placed overhead

A battery of four cameras was set up in the vault containing the records. Under the glare of powerful lamps, a clerk slipped a volume in place. Shutters clicked, and the camera film was advanced one space as its operator pressed a foot pedal and turned over the page. Thus in a few weeks, page by page, the entire 2400 volumes were filmed.

At the firm's office, the records were thrown on screens while clerks speedily cross-indexed them. Each machine was equipped with a device by which the operator could spin the film to any point, just as if he were turning the leaves of a book. The task was completed in 4 months. The film records, preserved in the company's vaults, are now an instantly accessible and complete library of real estate information.

Sam Loyd's Puzzles

Time Your Mental Speed

Six Fascinating Tests to Gage Your Abilities

THE world's most famous puzzle maker offers here another set of his newest wit sharpeners. Your speed and accuracy in answering them will help you measure your mental equipment.

Hundreds of our readers have told us of the pleasure and profit they have derived from Sam Loyd's problems from month to month. To use them as mental tests, time yourself in solving them, then turn to page 133 for the correct answers and your rating.

How Clearly Do You Think?

THE old phrase, "as difficult to guess as the first cost of a lobster," originated in the House of Representatives during the bitter tariff war between John Quincy Adams and Andrew Jackson in 1829. During the debate regarding a tax on raw material, a representative of one of the eastern states asked how it was

possible to calculate the first cost of a lobster. This member, when pressed to tell what he knew about the price of lobsters, could only say: "Prices vary, but the original lobster catchers receive as many shillings for six dozen lobsters as they give lobsters for thirty-two shillings."

Now, from that rather confusing data, are you a clear enough thinker to figure quickly the original cost of a lobster in Andrew Jackson's time?

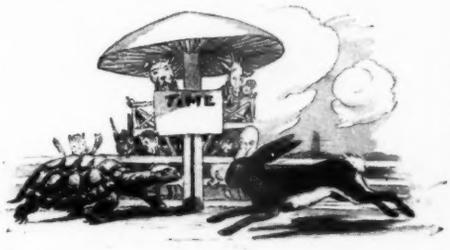
Note how long it takes you to answer, then turn to page 133 for your rating.

A Problem of Logic

A CORRESPONDENT wishes to know if there is a law in any of our states which would have prohibited his grandfather from marrying the sister of his widow.

At first blush, it would appear that his grandfather must first have died to make his wife a widow, and so have been disqualified from marrying his widow's sister. But closer inspection leads us to advise the young man that his granddaddy was within his rights in leading the sister of his widow to the altar.

Bring your logic to bear on this problem, time yourself, then see, on page 133, whether you possess a legal mind.



Can You Concentrate?

A SPORTIVE young hare, ambitious to disprove Æsop's aspersion on his forefathers, challenged a tortoise to race him around a circular track 100 yards in circumference. They were to race in opposite directions, and the hare gave his rival a start of one eighth of the distance.

The hare held such a mean opinion of the other's ability that he loitered along, nibbling the grass, and only realized that the plodding tortoise was threatening his prestige when they met at a point where the hare had run but one sixth of his 100 yards. The aroused hare went at top speed for the remainder of the distance and was lucky enough to make the contest a dead heat.

How much faster did the hare go during that spurt than he went up to the time of their meeting? Here's a chance to test your ability to concentrate. Time your answer; check your rating on page 133.

Are You Quick at Figures?

A LAND speculator, having paid $25,000 for a likely looking tract, divided it into plots of three lots each, which he disposed of at $750 per plot. His gross profits equalled his cost for seventy-five of the lots.

Can you tell just how many plots the tract contained?

Time yourself in solving this situation, then turn to page 133 to measure how high you stand in arithmetic.

Where Ingenuity Counts

BARON D. and Count C., two jovial gentlemen I encountered in the card room of a steamer, offered to initiate me in the mysteries of a new game. I lost the first game, and the baron and the count each won enough to double the stack of chips with which he started. The baron and I scored the second game, thereby doubling our respective table assets. Then, in the final skirmish, the count and I scored, doubling the chips which he and I had at the opening of the third game.

A mysterious feature of our session was that while each player won twice and lost but once, the baron and count quit winners, and I was a loser to the extent of four dollars. After that third game, our three stacks of chips were just alike. How much money did I put on the table when I started?

This is a problem that will tax your ingenuity. See page 133 for your rating.

Your Power of Analysis

AUNT MARY bought some peanuts for the children and gave to the eldest, a boy, one peanut and one quarter of the remainder. To the next in age, a girl, she likewise gave one peanut and one quarter of the remainder. To the third, a boy, she also gave one peanut and one quarter of the remainder. The smallest, a girl, also received one peanut and one quarter of the remainder.

It was found then that the boys had received 100 more peanuts than the girls. How many peanuts did Aunt Mary keep for herself? Here is a test of your power of analysis. Time yourself, then refer to page 133 for your rating.

Sam Loyd has prepared another set of his fascinating new test puzzles, which will appear in next month's issue.

Is *Your* House Too *Hot* or *Cold*?

How Proper Insulation of Walls, Roof and Floors Will Give Summer Coolness and Cut Winter Heating Costs

By JOHN R. McMAHON

"BOYS, we'll freeze to death unless we get shelter," said the leader of an Arctic expedition to his party, caught in a blizzard far from their base camp.

All hands began to cut blocks of snow and ice. These they laid in a circle, flying sleet cementing the joints. Within a short time the shivering men were snug and safe within the igloo, enjoying a hot supper. A small alcohol stove made the house almost too warm. The men stripped to their underwear. And it was fifty below zero on the other side of the snow walls!

About the same time, a group of explorers in the tropics received the happy gift of a cake of ice from a passing river steamer. How could they make it last with a temperature of 105 in the shade?

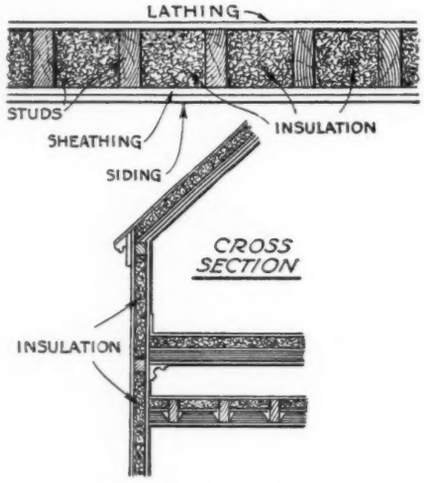
"We'll wrap the ice in woolen blankets, men," said the leader. "That will keep it until tomorrow, anyhow, and give us some long, cold drinks!"

Between ice and wool, used for seemingly contradictory purposes in these two incidents, lies the story of insulation. It is a story that is important to all of us in its application to home comfort and economy. At first sight it is quite simple. But little study develops that the subject is as tricky as an outlaw mustang.

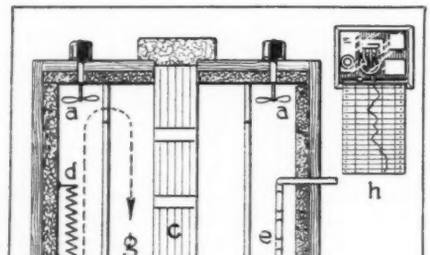
SCIENTISTS tell us that dead air is the supreme insulator. If that is so, why squander money on other materials when air is free and we can have plenty of it within our walls? The scientists explain that such air is not properly dead: it moves; it transmits heat and cold.

To insulate practically, we must confine air, neither too much nor too little. A material that is merely air-tight is not enough; rubber coats and window glass, for example, are useful wind stoppers but do little to exclude cold. In buying our underwear, we do not buy on a basis of thickness; heavy cotton is not equal to thin wool, which somehow keeps a better grip on its confined air. In general, light, porous materials are better insulators than dense, heavy ones. Cypress excludes more cold than maple, brick more than granite.

Our ancestors solved the problem by building extra thick walls. We thinned the walls, having superior heating systems for winter; ice and electric fans for summer. Today there is a general tendency to insulate houses both for winter and summer. People are beginning to realize that a house properly insulated means that they no longer need swelter and lose sleep on midsummer nights because the place is like an oven.



Method of insulating a house with mineral wool used as loose packing in walls and between floors



How the Bureau of Standards tests heat and cold resistant qualities of wall materials. *A*, warm chamber; *B*, cold chamber; *C*, panel under test; *a*, electric fans; *d*, electric heating coil; *e*, ammonia cooling coil; *f*, heating control coil; *g*, conductimeter and guard panel; *h*, recording thermometer

While the best job of insulation is done on a new building, much improvement can be effected upon an old structure. You can insulate your walls, roof and attic floor without great difficulty. Where remodeling or even ordinary replacement is planned, insulation means simply selecting and applying the right material instead of anything that happens to be available.

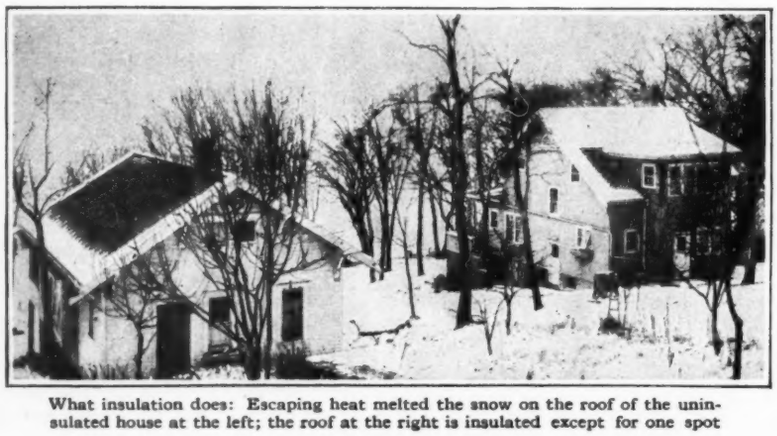
In general, figures for the insulation values of complete house walls place a wood house at the top of the list. That is, a wood frame house, with siding, paper, sheathing, lath and plaster, will be coolest in summer and warmest in winter. Next ranks a brick house with eight-inch walls furred and plastered.

Following is a list of wall values as given by various authorities. These values are measured by the number of heat units—called British thermal units, or B. t. u.—that pass through one square foot of stated thickness in a given time for each degree difference between inside and outside temperature. From an insulation standpoint, therefore, *the smaller the figures, the better the material.*

	B.t.u. per hour
Brick, 8 inches thick	.42
Brick, 8 inches thick, furred and plastered	.27
Concrete, 8-inch	.6
Hollow tile, 8-inch, with stucco	.41
Hollow tile, 8-inch, furred and plastered	.29
Concrete blocks	.6
Concrete blocks, furred and plastered	.4
Wood frame, siding, paper, sheathing, lath and plaster	.2

These figures, it must be noted, are not accepted by all authorities, owing possibly to differences in methods of testing and to variations in material. A point of general agreement is the gain through having an air space, whether due to air or the added resistance of another wall or both. It also appears that in wood frame every detail toward standard construction counts. Paper alone saves a loss of .07 of a heat unit for each square foot of surface every hour.

Another important fact on which authorities seem agreed is that one inch of air among several insulating materials on the market in sheet or quilt form is about equal to an eight-inch outside wall of frame or masonry. This indicates



What insulation does: Escaping heat melted the snow on the roof of the uninsulated house at the left; the roof at the right is insulated except for one spot

that insulation pays by a good margin. But we should not argue from this that a wall plus half an inch of insulating material equals a wall and a half. Considering the effect of insulation on the house as a whole, we must remember that window glass area remains the same and is a constant source of loss. If a wall is one fifth glass and its resistance to heat and cold is doubled by the addition of insulating materials, the total improvement is actually only eighty percent.

TURNING now to the values of the insulating materials themselves, we find that definite figures have been established by the Bureau of Standards at Washington. To the man contemplating insulating his house, these figures are of inestimable value. The Government scientists made their measurements with delicate electrical apparatus. Their samples and methods were uniform. They tested a large number of materials under their trade names.

At the head of the Government list, with insulation values between .25 and .29 for a thickness of one inch, we find kapok, wool, hair felt, slag and mineral wool, felt and other fibers quilted in paper, corkboard, cotton wool. Several of these materials are loosely packed, and the corkboard sample has no artificial binder. That cotton wool, sheep's wool and mineral wool are much alike in insulating value will surprise most persons.

Among these substances, mineral wool is used as loose packing in walls and between floors. Quilted material is flexible, comes in rolls and is nailed to studs in frame construction. Corkboard is usually one inch or more thick, and in pieces one foot wide by thirty-two or thirty-six inches long. It may be nailed to studs and directly plastered, or placed against the inside of a masonry wall to which it is "glued" by a half inch layer of rich mortar. Corkboard less than an inch thick is hardly advisable for use on studs because of lack of strength, especially owing to the narrow width of the pieces.

THERE are about a dozen materials to which the Bureau of Standards gives a rating between .29 and .33, or slightly less in insulating value than the materials above. Even at this figure it appears that an inch of insulation stops as much heat and cold as the ordinary outside wall of a dwelling which is eight times as thick. And the cost is small—being three to twelve cents a square foot for material.

Labor costs, obviously, are least when the material is in large and rigid sheets, as is the case with wood fiber board. This may be plastered direct inside, but furring strips with wood or metal lath are advised for stucco exterior.

A special wood fiber board is required for direct plastering or placing next to masonry. And with this it is advisable to use a quick-setting gypsum plaster with not more than ten percent of lime, to set within two hours, to avoid swelling of the fiber through moisture. A space of three sixteenths inch between the board units allows for expansion.

Photo Armstrong Cork & Insulation Co.

Corkboard has high insulating value. It may be nailed directly to roof rafters, as shown in the photo above, and plastered

Photo Weyerhaeuser Forest Products

(Left) Applying balsam wool between the studding. Its flexibility enables it to be tucked into corners and fitted around projections

Photo Samuel Cabot Inc.

Insulating "quilt" being applied to studding and covered with lap siding. Reduced heating cost more than offset the insulation cost, this owner figured

Sugar-cane fiber board is plastered direct in the same way. Moisten the board with light sprinkling one day before application. If the ceiling is to be plastered, put a cross piece or header, so-called, every four feet between ceiling beams, which are presumably of standard spacing—sixteen inches on centers. Nail the board with one-and-one-half-inch roofing nails three inches apart at the outer edges and six inches apart on interior studs or beams. Insurance against cracking of plaster at the joints may be had by nailing over them strips of metal lath four inches in width. The sugar-cane board is also used for outside stucco, preferably with lath on its surface, and sometimes the stucco is applied with a cement gun. The latter method of spraying on plaster with air pressure is speedier than elbow grease, but it is apt to be messy and not equal to handwork.

About on an insulating par with the fibers of wood and cane is an odd-sounding material, "eelgrass inclosed in burlap." It reminds me of the swamp rushes which in southeastern Europe serve as lath under plaster. That it is not a novelty and is very resistant to decay is established by the condition of a sample which was built into a New England house 290 years ago.

The eelgrass is made up as a quilted roll three feet wide. When applied to wood frame, it needs the support of headers every three feet between studs or beams, unless put on sheathing or laid upon a subfloor. Furring strips are requisite for a plaster job. The quilt has a thickness of one third to three fourths inch.

Ceiba and balsa are tropical woods which, being very light and porous, have merit in house insulation.

A SO-CALLED wool has been produced from native wood and made into a flexible quilt one half to one inch thick and in widths from seventeen to thirty-three inches, for house insulating purposes. The finely cut fibers are treated chemically to resist fire, and the makers claim the material will not burn. An adhesive substance holds the fleecy fibers together and in firm attachment to the covers of asphalt-coated paper, which obviates stitching or puncturing the material. The quilt strips must run the same direction as studs, beams or rafters. Strips of seventeen-inch width may be placed between studs close to sheathing boards, the edge laps being fastened to stud sides with lath nailed through. Or wider quilt may be tacked over the inside top of studs, to be followed with lath and plaster or any kind of wallboard. The material may be applied over furring strips on the inside of masonry walls.

There doesn't seem to be any possible connection be-

(*Continued on page 134*)

Seven Handy Kinks *for* Autoists

Window Screens, Luggage Carrier, Table, Other Ideas

YOU can lash considerable bulky luggage to the running board of your car by the use of a rope arranged as shown in Fig. 1. The eyes should be bent up from an iron rod at least one quarter inch in diameter. By loosening the screws, the eyes can be turned under the running board when not in use.

Secret Switch Foils Thief

WHEN properly installed, the switch shown in Fig. 3 is so well concealed that the auto thief will never find it. As you get out of the car, slip the brass plate into your pocket, leaving the two screw heads exposed. The wires should be run inside the body lining so they will not show. If the sheet metal of the body extends over the surface where the screws are to be fastened, insulate the screws.

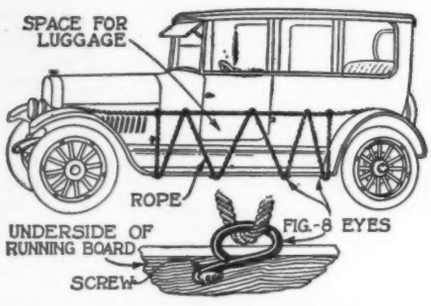


Fig. 1. Several special eyes and some rope arranged in this way will hold considerable luggage

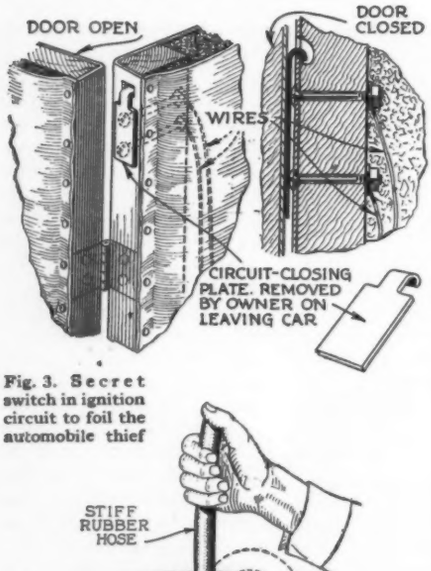


Fig. 3. Secret switch in ignition circuit to foil the automobile thief

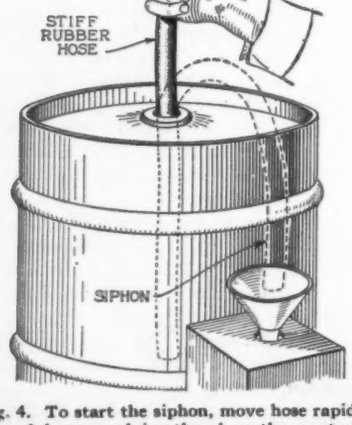


Fig. 4. To start the siphon, move hose rapidly up and down, applying thumb on the up stroke

Ten Dollars for an Idea!

PAUL KOSELKE, of Lansing, Ill., wins the $10 prize this month for his suggestion of the auto window screens (Fig. 5). Each month POPULAR SCIENCE MONTHLY awards $10 in addition to regular space rates to the reader sending in the best idea for motorists. Other published contributions will be paid for at usual rates.

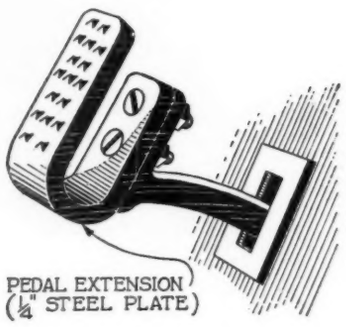


Fig. 2. A wrought iron pedal extension of this design is convenient, safe and easily made

Novel Siphon Starter

YOU can start a siphon with a piece of hose as in Fig. 4. Push the hose down with a rapid motion, at the bottom of the stroke clamp your thumb over the end; pull up and repeat until the hose is full of gasoline. This stunt will work only with gasoline or other free flowing liquids.

Screen Your Car

FOR auto camping trips, screen at least two of the windows as shown in Fig. 5. The cross members are hinged so the screen can fold up. Cloth netting is used, the upper edge fastened with snap fasteners and the lower edge held in place by the window pane, which is cranked up against the lower edge of the screen.

Switch to Control Generator

TO CONTROL the output of the generator, you can install a switch on the instrument board and wire it in series with the third brush and one or two headlight bulbs arranged in parallel (Fig. 6). When the switch is on, the bulb is short circuited and the third brush functions as usual. When the switch is off, the bulb is in series with the third brush and the output is increased.

Pedal Extension Easy to Build

SO LONG as cars are built to fit the average-sized person, the short man or woman will have trouble reaching the pedals. A strong, yet easily built extension can be built as shown in Fig. 2.

A Table for the Auto Lunch

FIG. 7 shows how to build a simple table that will prove useful for serving luncheon in the car. When not in use, it can be folded out of the way.

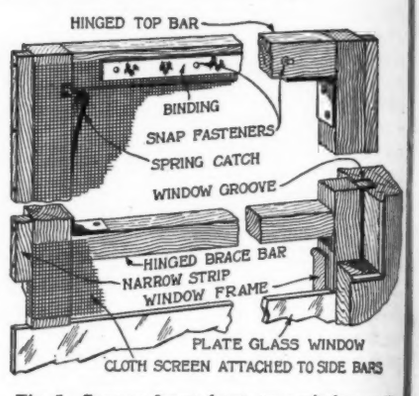


Fig. 5. Screens for at least two windows will add to your comfort when auto camping

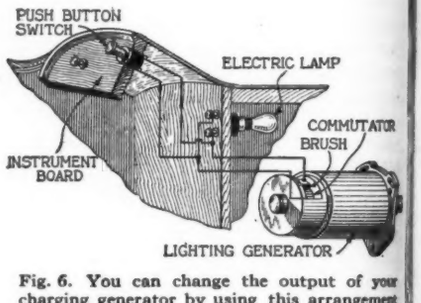


Fig. 6. You can change the output of your charging generator by using this arrangement

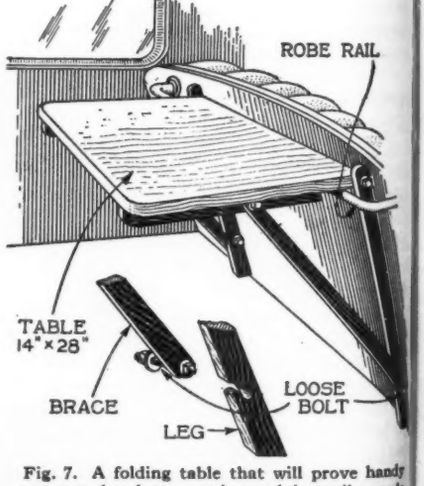
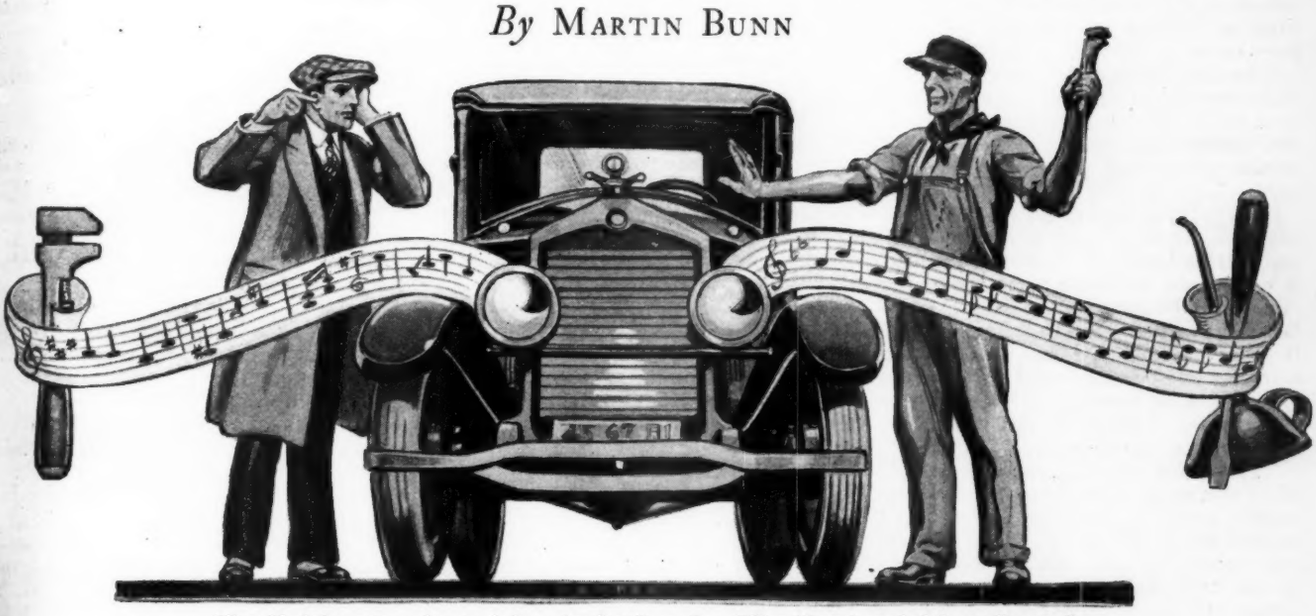


Fig. 7. A folding table that will prove handy on auto luncheon parties and is easily made

Stop *the* Noises *in* Your Car

Gus tells how to trace and cure the squeaks, rattles, hum and thumps that warn the driver something's amiss

By MARTIN BUNN



"Get rid of the motor and transmission noises first," says Gus. "Then it's easier to find the smaller ones"

"HEY, Joe!" Gus Wilson shouted to his partner. "See if you can't stop that infernal racket outside. I can't even hear this motor run, much less tell if there are any noises in it!"

Joe Clark swung open the door of the Model Garage and stepped outside. A second later the roaring and clattering subsided into a dismal clanking and then ceased altogether.

Gus, with a grunt of satisfaction, picked up his stethoscope and soon was completely absorbed in testing the car he was working on. The motor was purring as quietly as a contented cat, but Gus listened carefully at every point where there was any possibility of noises that would reveal incorrect adjustments in the mechanism.

"What are you doing—listening for the heartbeats?" asked a young fellow who had strolled up so silently that Gus hadn't heard him.

"I am," replied Gus, "if that's what you want to call 'em. Was that your car making all the racket outside?"

"Yes, but don't put that stethoscope of yours near my motor. It would bust your eardrums."

"SO I heard," Gus growled. "When are you going to overhaul that junk pile, anyway?"

"Junk pile! Where do you get that stuff?" snapped Will Otis, the owner of the noisy car.

"Maybe I'm anticipating a bit, Otis," said Gus with a grin. "If the car isn't junk by now, it will be very shortly if you leave it in that condition. Hang around a few minutes till I get this job out of the way and I'll have a look at it. You'll have to take me for a ride, though—I want to find out what else I can hear besides motor noises."

When the two men were in the noisy car, Otis stepped on the self-starter and the motor started with a clattering roar. They drove about a mile, which included one rather steep hill. Gus made no remarks during the ride, but he was making mental notes of the various queer noises that were assailing his ears.

"I'm afraid it's going to be a long list," he said as they pulled up in front of the Model Garage. "Some of the troubles are your own fault and the rest of 'em are just natural wear or things that are loose.

"BETTER make a list so you won't forget any of 'em. First there's a dull thump that means a loose main bearing, I'll bet a hat. Then there's at least two connecting rods that need taking up. You can hear the metallic clank they make clear enough. Those clicking noises are loose valve tappets, and I wouldn't be surprised if the cam shaft is a trifle loose, too.

"That rumbling, grating noise that comes and goes with changing motor speeds probably is a loose timing chain that hits the side of the case now and then. And the rattle when you step on the throttle sounds to me like loose pistons. By the way, when did you put grease in the transmission last?"

"It must have been nearly a year ago," confessed Otis sheepishly. "I forgot about it, I guess."

"It costs money to forget things like that," said Gus. "It sounded dry as a bone. I hope the gears and bearings aren't worn too badly. The rear end has quite a hum. I suppose you haven't put anything in the differential case for a year, either."

"I guess that's right," admitted the other.

"You ought to have those things fixed," said Gus. "The question is, though, do you want me to fix everything or do you want to do some of the work yourself? All the things I mentioned are shop jobs, but there's plenty of noises about the car that you can fix yourself, if you want to save money."

"Sure I want to save money," replied Otis. "If I don't, I won't have any to pay your bill for the rest of the work. What are the things I could fix?"

"Don't worry about them until I get rid of the motor, transmission and rear end noises," Gus advised. "It will be much easier to find the smaller noises after the big ones are cured."

"ALL right," Otis agreed. "I'll leave the bus here and you can get busy on the work you've mentioned. When shall I come back?"

"In about a week," suggested Gus.

Otis showed up about a week later and Gus was ready for him.

"Take me for another ride," said Gus, "and see if you notice any difference."

Otis said nothing until they had driven several blocks.

"I can hardly believe it's the same car!" he burst out enthusiastically. "Now I can see why you didn't want to have me bother about the rest of the noises. They were drowned out by the ones you fixed. The motor sounds fine now, and the hum in the rear end is gone, but there's a fine collection of rattles and squeaks I never noticed before. Where do they all come from?"

Gus smiled. "That's for you to find out," he said. "Finding squeaks and rattles is just a matter of patience and keeping at it. Rattles are easier to find than squeaks because a rattle always means something is loose somewhere. Squeaks are hard to find because parts can be fastened together so tightly that you can't detect any looseness, and yet the jounces and jars will make them rub together enough to squeak like the dickens.

"The first thing to do is to get out your wrench and screw driver and go over every nut and screw you can find—and from the way this car rattles, you'll find plenty of loose ones.

"It's surprising what a loud rattle can come from a small part that's just a trifle loose. At certain motor or car speeds, the loose parts get to vibrating. The smaller the part, the faster the rattle. Keep that in mind. If you hear a real fast rattle, you know it must be some small part like the license plate or a section of the piping or perhaps one of the small rods that work the spark and throttle.

"Those clattering noises you hear only when you strike a bump in the road are usually made by some large part that's worked loose. Worn brake rod clevises and spring bushings make these parts clatter like sixty when you go over bumps. Of course there isn't any way to tighten up on spring bushings or brake rod clevis bearings—you've got to replace them. Sometimes, though, most of the wear is on the clevis pin or the bolt that goes through the bushing in the end of the spring. In that case you can get rid of a lot of the looseness by using new pins and bolts."

"Why can't I just tighten the nuts on the end of the spring bolts until they bind a little bit?" asked Otis.

"DON'T try any bum mechanic's job like that!" Gus growled. "In the first place, it won't work because spring bolts are built with a shoulder that keeps the nut from doing anything except stopping it from turning. In the second place, the bolt wouldn't stay tight for any length of time even if you screwed the nut on hard enough to cramp the spring clip against the end of the spring.

"That's nearly as bad as the job I saw a fellow who called himself a mechanic do on a brake rod clevis. He put it on the anvil and pounded it with a hammer until he had the holes oval in shape. They stayed tight for almost two weeks," Gus concluded.

"Oh, I wouldn't do anything like that," Otis grinned. It had been on the tip of his tongue to suggest that particular idea.

"Now, about those squeaks," Gus continued as they stopped in front of the Model Garage, "don't be discouraged if you can't seem to find them at first. Remember that a cricket can make a whale of a noise just by rubbing some of its parts together. Wherever there's any chance for two surfaces to rub together, no matter how slight the motion is, there's a chance for a squeak.

"Squeaks are the result of vibration, and vibration is set up between two surfaces that are rubbing together only when there is the kind of friction you get when the surfaces are dry. Dry wood rubbing against dry wood or against metal will start vibrations that travel through the whole mass of wood or metal. Then the air carries these vibrations to your ear and you hear squeaks.

"THAT'S why a car doesn't squeak so much when you are out in the rain. The water gets between the rubbing surfaces and lubricates them just enough to stop vibrations. Also, the water swells the wood and makes the joint much tighter, thereby eliminating friction.

"Wood wheels that squeak after a spell of dry weather can be cured by throwing a pail of water over them. Rattling floor boards sometimes can be quieted in the same way.

"Of course, oil stops squeaks much better than water because it doesn't dry out in a few days. But you wouldn't want to squirt oil all over your car on the chance that it might stop a couple of squeaks you can't locate.

"If you suspect that a squeak is coming from a particular spot—say from the edge of one of the doors—you can test it by putting a little oil on the surfaces that are worn bright by friction and see if the squeak stops. If it does, you can tighten up the fastenings of the door so there won't be any chance for motion.

"And don't jump at conclusions in deciding where the noise is coming from," Gus continued. "Sometimes one loose part will make a noise that is a good imitation of the noise you are likely to hear from some other part. A fellow came in here the other day to have the main bearings of his motor tightened up. He had heard a dull thump whenever the motor was pulling hard on a hill. I found the trouble, but it had nothing to do with the bearings of the motor. One of the bolts that held the motor in the frame was loose, and every time he opened the throttle and the motor began to labor, it just naturally bounced up and down with a thump that certainly sounded like main bearings.

"Then there was another chap who came in to have the commutator on the generator touched up because he said it was squealing like blazes. Come to find out, it was the stuffing box bearing on the water pump. He had forgotten to lubricate it, and the dry packing was setting up enough friction to produce a nice, loud squeal.

"One queer noise that bothered me for a while in a car I was working on turned out to be loose plates in the muffler. At certain speeds downhill, the loose plates would slide forward, closing up the passages. Then the gas pressure would slap them back again with a sound that was a cross between a clank and a thud."

"There's a bit of a commutator squeal from the generator of this car," Otis interrupted. "What's the best way to get rid of it?"

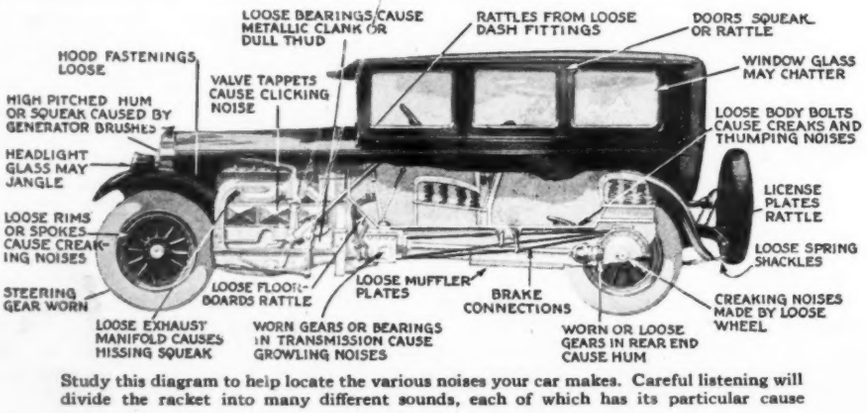
"DON'T do anything," Gus replied. "I looked at the commutator and it seems to be in good condition. Often a commutator will develop a squeak that will go away by itself if you let it alone. Of course, if the commutator is worn or the brushes get so loose in the holders that they start chattering at certain speeds, you ought to have the commutator trued up and fit new brushes. Sometimes the commutator will take on a kind of dirty glaze that makes it squeak. Wiping it off with a rag and a little gasoline will usually fix that particular trouble. It isn't a bad idea to clean the commutator that way once in a while, anyway, and while you are about it, scrape the accumulated carbon dust that is ground off the brushes out of the slots between the copper bars."

"Gee!" exclaimed Otis, "I can see I have a lot of heavy detective work ahead of me to smoke out all the squeaks on this car."

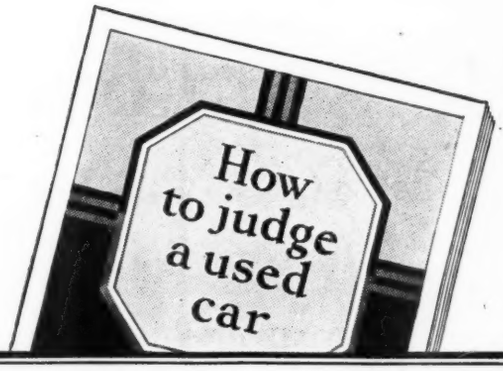
"That's the penalty for having a quiet motor," said Gus. "Keep at it, though, and eventually you'll at least get rid of the worst noises."

Gus says—

"A WRENCH, a screw driver, an oil can and plenty of patience and perseverance are the tools you need to get rid of squeaks and rattles in your car. Remember that the loudness of the squeak is no indication of the amount of motion between the parts that are causing the noise. And the squeak doesn't always seem to come from the parts that are actually producing it. Usually the vibration is carried to some other part that sends the vibration to your ear."

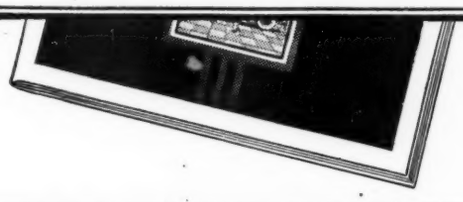

LOOSE BEARINGS CAUSE METALLIC CLANK OR DULL THUD
RATTLES FROM LOOSE DASH FITTINGS
DOORS SQUEAK OR RATTLE
HOOD FASTENINGS LOOSE
VALVE TAPPETS CAUSE CLICKING NOISE
WINDOW GLASS MAY CHATTER
HIGH PITCHED HUM OR SQUEAK CAUSED BY GENERATOR BRUSHES
LOOSE BODY BOLTS CAUSE CREAKS AND THUMPING NOISES
HEADLIGHT GLASS MAY JANGLE
LICENSE PLATES RATTLE
LOOSE RIMS OR SPOKES CAUSE CREAKING NOISES
LOOSE SPRING SHACKLES
STEERING GEAR WORN
LOOSE FLOOR-BOARDS RATTLE
LOOSE MUFFLER PLATES
BRAKE CONNECTIONS
CREAKING NOISES MADE BY LOOSE WHEEL
LOOSE EXHAUST MANIFOLD CAUSES HISSING SQUEAK
WORN GEARS OR BEARINGS IN TRANSMISSION CAUSE GROWLING NOISES
WORN OR LOOSE GEARS IN REAR END CAUSE HUM

Study this diagram to help locate the various noises your car makes. Careful listening will divide the racket into many different sounds, each of which has its particular cause



Do you know:—
—how to avoid "orphans"?
—how to buy a used car from a friend?

Invest 2¢—you may save $200



Pledge to the Public
on Used Car Sales

1 Every used car is conspicuously marked with its price in plain figures, and that price, just as the price of our new cars, is rigidly maintained.

2 All Studebaker automobiles which are sold as CERTIFIED CARS have been properly reconditioned, and carry a 30-day guarantee for replacement of defective parts and free service on adjustments.

3 Every purchaser of a used car may drive it for five days, and then, if not satisfied for any reason, turn it back and apply the money paid as a credit on the purchase of any other car in stock—new or used. (It is assumed that the car has not been damaged in the meantime.)

To the Public: We pledge adherence to the above policy in selling used cars.

Your Studebaker Dealer

Write us *now* for your copy *of this free book!*

AS A GIFT to motorists on its seventy-fifth birthday, The Studebaker Corporation of America published a remarkable new book.

The fund of facts in "How to Judge a Used Car" may easily save you $200 or more in buying a used car! This valuable, free buyer's guide reveals frankly how to judge used car values, how to find the best bargains—prints startling information never before made public.

Boiled down into ten minutes interesting reading are the safeguards experienced *automobile dealers* apply when *buying* used cars for resale. Every paragraph is the summary of years of experience—every page is full of time-saving, money-making pointers.

Pictures and text in this helpful used car manual show *you* what code prices mean, why dealers turn the speedometer back to zero, how to fix the value of a used car offered by a friend, how to avoid "orphans"—and other important points the average buyer would overlook.

Send the coupon below *now* for your copy of this helpful guide to greater value. Learn how to get more for your motoring money. Invest 2c in a postage stamp—it may save you $200!

THE STUDEBAKER CORPORATION OF AMERICA
Department G56, South Bend, Indiana
Please send my copy of valuable free booklet, "How to Judge a Used Car."

Name .....

Street .....

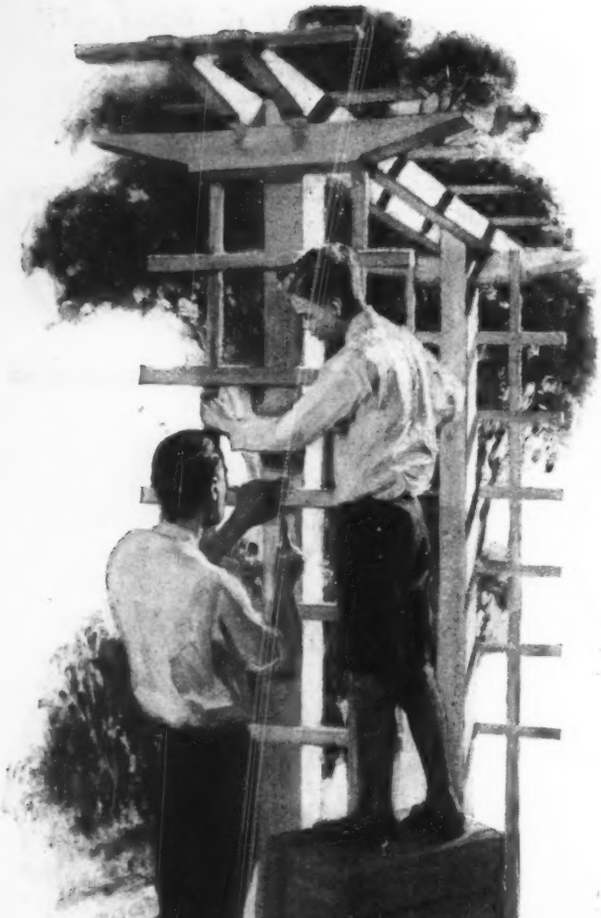
Town ..... *State* .....

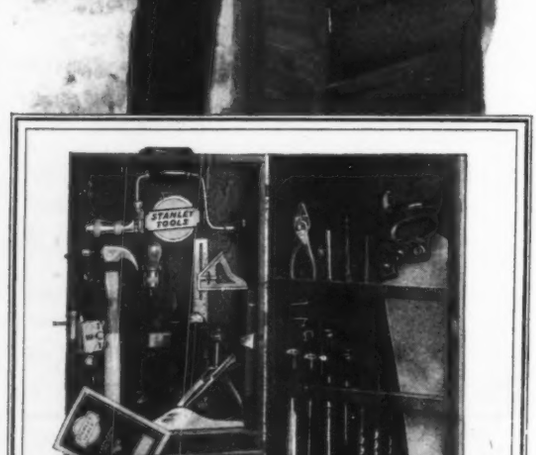
Sign and Mail the Coupon Now!

STUDEBAKER

This is a Studebaker Year

On making a House into a Home





Buy separately or in assortments

Make a Garden Trellis from Plan No. 22e

A HOME is what *you* make it. It starts as a bare house on a plot of ground. Then some one sets out shrubs. The first skimpy grass develops into a rich green lawn. Vines—either plain or flowering have turned many a house into a *home*. Have you ever thought of building a garden trellis? It is comparatively simple when you have Stanley Plan No. 22e to help you.

But did you ever think of this? The occasional user of tools needs good ones even more than the professional. For good tools are a real encouragement to good work.

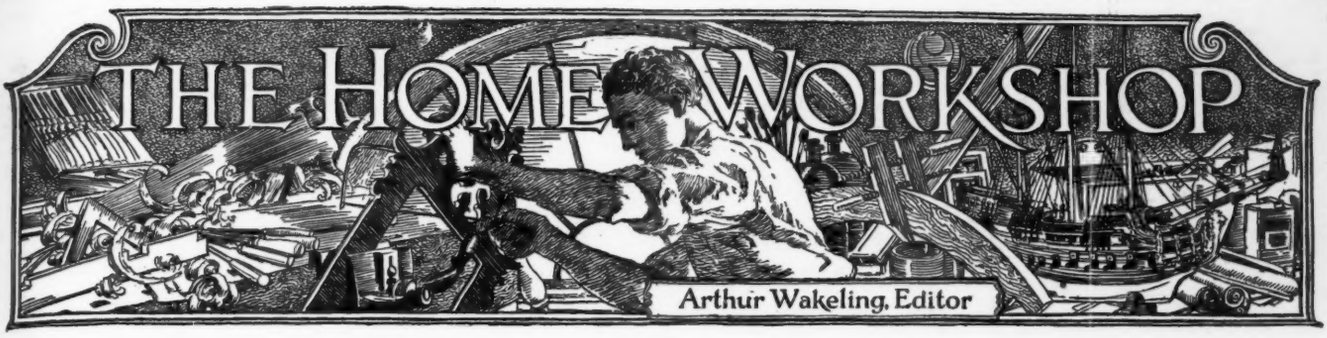
You can buy Stanley Tools separately and so collect your own set. For your convenience in buying there are also complete sets of Stanley Tools in chests at a wide variety of prices from $15 to $95. Or there are assortments in strong cardboard boxes containing directions for making your own tool chest. Priced from $5 to $20.

Your hardware dealer has Plan No. 22e as well as other Stanley Plans for making useful articles, or he can get them for you. The plans cost only 10c each. Ask him, also, for small Catalog No. Se50, which shows many useful Stanley Tools. It is free. If he cannot supply you write to The Stanley Works, New Britain, Conn.

The best tools are the cheapest to use
Ask your hardware dealer

STANLEY TOOLS

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6



How to Apply Art Transfers

You Can Decorate Furniture and Craft Work with Astonishing Ease by Using Inexpensive Decalcomania Designs

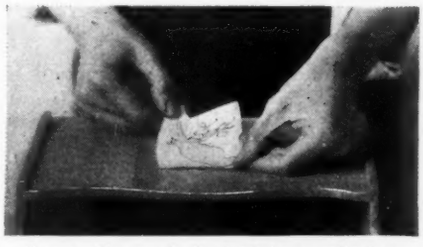
By BERTON ELLIOT

SO POPULAR has become the use of transfer patterns on commercial furniture and art wares that it is surprising more home workers have not taken advantage of this decorative vogue. Many, of course, do not understand how easily transfers are applied and still fewer amateur decorators appreciate the variety of brilliant effects made possible by these designs.

Decalcomania (de-kal-ko-mania) transfers, as they are called, have been used in the furniture trade for years to give expensive pieces the artistic finishing touches they need. Now they are available, too, in almost all department stores (usually in the paint or art materials departments), as well as in many neighborhood hardware, wall paper, and paint stores; and they are carried by the larger mail order houses. An almost endless variety of designs, motifs, colorings, shapes and sizes can be obtained.

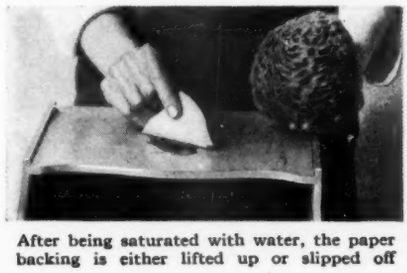
A transfer is nothing more or less than a paint film attached temporarily to a paper backing. When applied to enameled or lacquered furniture or other finished surfaces, the paper backing is moistened and removed, the paint film being left attached to the surface.

Varnish or other adhesive is applied to the transfer and allowed to stand until "tacky"



A center line on the back of the transfer is a great aid in placing it centrally and vertically

The transfer is pressed down, from the center outwards, with a rubber roller or a cloth



After being saturated with water, the paper backing is either lifted up or slipped off

Some transfers are quite flat, while others have a texture and depth that make them appear almost as if hand painted. The best types have virtually the appearance of hand painting; you can see the brush marks!

The main use of transfers is, of course, on painted furniture, that is, on pieces which have already been finished with white or colored enamel or lacquer. They are used less often, but frequently with striking effect, upon natural finished furniture—pieces that have been stained and varnished. The many ways in which this can be done are best learned by observing closely good examples in a high class furniture store.

Among the most popular motifs are *floral* designs, which are appropriate for almost every decorative purpose. *Ships* are much in vogue at present, although their use is more restricted, as are *bird* and *fruit* designs. Many colorful *nursery* pictures can be obtained; these work wonders in brightening up both the furniture and permanent woodwork in children's rooms. *Silhouette* transfers fill the need for a contrasty, posterlike style of treatment. *Medallions* are useful for (*Continued on page 88*)

Building a Corner Closet

An Easy Method of Constructing a Colonial China Cabinet in Any Dining Room—How to Keep the Cost Low

By Everett Eames

OF THE many decorative and useful built-in furniture units now obtainable, the corner china closet ranks among the first in the estimation of home owners. This is as it should be, for not only do the fine lines of Colonial doors lend dignity and charm to a room, but the spacious interior of the closet holds all the china, cut glass and table linen that a family of ordinary size requires.

This type of closet is a favorite with housekeepers, because it is out of the way and takes less floor space than the ordinary cumbersome and somewhat fragile china closet.

As the first step in building a closet of the type illustrated, it is a good plan to make the lower door. It is not necessary for the amateur woodworker to construct it by millwork methods, as a satisfactory door can be made more easily.

The lower door of this charming closet, with its triangular paneling, is reminiscent of the so-called Connecticut style of Colonial architecture, of which there are several examples in the Metropolitan Museum of Art, New York

Glue together ⅞ in. thick white pine, bass wood or whitewood to make a board 2 ft. 3 in. by 2 ft. 11 in., the grain running the short way. Prepare two strips ⅞ in. by 2 in. by 2 ft. 11 in., and then have a mill man cut grooves along one edge of both of these, and along each long edge of the large board, so that the parts may be glued together with a tight maple spline in the grooves. You can, of course, cut the grooves yourself, if you have a suitable plane.

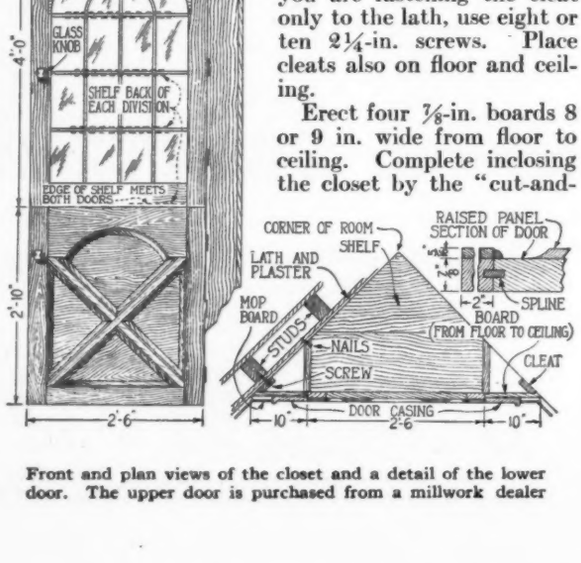
THE panel effect is obtained by gluing on ⅝ in. thick pieces, as indicated. The dimensions given do not have to be followed exactly, but it is well to maintain about the same proportions.

A quarter-round molding, in this case of oak, is boiled or steamed until pliable enough to be bent into place around the curved edge of the upper triangle. It is fastened with glue and brads. Use freshly prepared hot glue and have plenty of confidence in it, as it will not allow the parts to separate when once they have been clamped tightly and allowed to dry.

Perhaps the upper door is beyond the abilities of a good many home workers, but one may be purchased already glazed from a millwork supply house. In this case the door cost $7.50.

To build the closet proper, screw cleats to the wall after beveling them to receive the upright boarding. If you happen to strike a stud, only a few long screws are required, but if you are fastening the cleat only to the lath, use eight or ten 2¼-in. screws. Place cleats also on floor and ceiling.

Erect four ⅞-in. boards 8 or 9 in. wide from floor to ceiling. Complete inclosing the closet by the "cut-and-fit" method, first making the top section of the wall over the door, then the casing, and lastly the shelves. Bear in mind that you are building the closet to suit the doors.



Front and plan views of the closet and a detail of the lower door. The upper door is purchased from a millwork dealer

The shelves, which are supported on cleats, must be lined up carefully, so that their edges will correspond with the door divisions.

In hanging the doors, use three or, preferably, four 2-in. loose-pin hinges. Ball-and-socket catches are the neatest type to use for the doors and are sufficiently strong.

The color scheme of the room governs the painting of the doors and trim. Usually a cupboard of this kind is white or cream colored enamel, or it is stained mahogany or walnut and varnished to match with the furniture. The interior should be white.

The wall surrounding the door casing can be sized and papered, or painted to match the walls of the room, and the picture molding and mop board carried around as circumstances require.

If the builder wishes a secret hiding place, it is possible to leave a section of the top of the closet loose, so that small objects can be inserted into the space above.

How to Resharpen Cutters of a Pencil-Pointing Machine

TO RESHARPEN the revolving cutters of a standard pencil-pointing machine, obtain a 3/16-in. wooden dowel about 4 in. long and sharpen as if it were a pencil. Dip the pointed end into a mixture of oil and fine emery and insert in the machine. Hold the stick stationary and turn the handle of the machine backward. Withdraw the stick when necessary to renew the emery and repeat the process several times. When the cutters have been restored to their original keenness, wash off the oil and emery with gasoline. —R. R. Rundell.

When the large blade of a jackknife is broken, the stub can be ground so as to form a small screw driver toward the back, where the steel is thicker. The thinner edge of the stub, if ground off square and left with a sharp corner, will serve for opening cans. A small notch in the stub will aid in scraping insulation from the ends of insulated wires.—L. T. K.

A Driveway *for* Your Garage

How to Lay Concrete Tracks at Lowest Cost—Materials You Will Need—Making the Forms—Methods of Mixing

By Robert S. Lewis

ALTHOUGH more or less permanent driveways can be made of finely crushed stone, cinders, gravel, flagstone, planks, and other materials, solid concrete ultimately proves the most satisfactory. Anyone, if properly advised, can construct his own concrete runways.

Narrow runways, 16 to 24 in. wide and spaced 56 in. center to center, make a neat driveway. Dig the trenches a few inches wider and 5 or 6 in. deep. Tamp the bed thoroughly with a tamper made by nailing two handles to a block of wood. Alternately soak with water and tamp the ground until you can walk on it without leaving a footprint. If the runways are being built on earth recently filled in, it is best to soak and tamp every day for a couple of weeks.

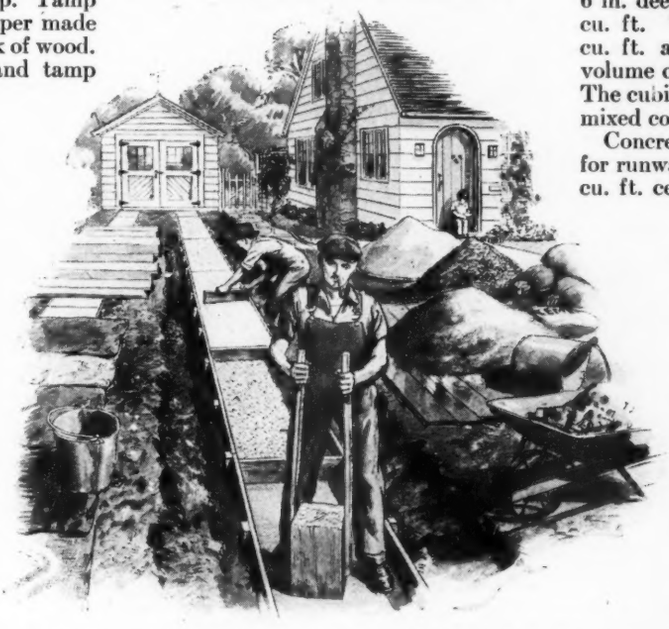
The final bottom of the trench should be about 6 in. below the ground or lawn surface if the runways are to be flush, but there is no objection to making the runway surface an inch or more above the lawn.

Large boulders should be removed if directly under the runway, as the concrete may crack over such an unyielding point. Small boulders and gravel furnish an excellent base. In unusually soft ground it is desirable to have six inches or more of well-tamped gravel and stones to support the concrete. If the soil is spongy or marshy, it may be necessary to make "spread footings" by widening the bottom of the trench to 30 inches or so and laying solidly packed rock and gravel about 8 in. deep. Such conditions are rather rare.

USE cheap, green lumber for the forms, as it will warp less than dry boards. The planed surface should be next to the concrete. Boards 1 by 6 in., surfaced on one side and one edge, will be satisfactory; 1 by 4 in. boards can also be used, but the upper edge should be kept 6 in. above the bottom of the trench.

Set the boards end to end in the trench and outside of them drive short stakes wide enough so that the ends of the boards can be nailed to them, each end with two sixpenny nails. From extra boards cut a dozen or more spacers as long as the runways are to be wide. Set them every 4 ft. Place stakes outside and nail the side boards to them. The stakes should be driven down or cut off flush with the top edge of the forms. The spacers are removed just as the concrete is poured.

The alignment and grade are obtained by establishing stakes at each end of the runway, with a wire or cord drawn tightly between. It must hang free from the boards in order to remain straight. By making the lines parallel to the house and extending them by sighting through, accurate alignment can be obtained.



After the earth in the trench has been thoroughly tamped, the forms are filled with concrete section by section and then covered to protect the surface of the cement and to prevent too rapid and unequal drying

Cement comes in bags of about 94 lbs. each, approximately 1 cu. ft. It must be stored in a dry place. It is usually better to order just before using. Lumpy cement, if it has not been exposed to dampness, can be rolled out or the lumps removed by hammering with a round stick. Lumps that cannot be crushed in the hand should be discarded.

A great deal of poor concrete comes from a tendency to use the most available gravel and pebbles, some of which may be quite unsuitable. If sand is to be obtained in the neighborhood, test it by stirring in a glass of water; cloudy water and the presence of considerable sediment at the bottom of the glass, indicate too much loam and dirt.

In general, it is necessary to buy suitable sand. River sand is usually clean, but it is often too fine to use unless mixed with coarser sand. Sand that has an odor or soils the hands is quite unfit for concrete.

Coarse aggregate makes up the large bulk of the concrete; this consists of gravel or crushed stone, for preference, or cinders, trap rock, and similar materials. This aggregate must be free from dirt and clay. No stones over 2 in. long should be used. Never use shale or soft materials that tend to crumble.

The total cubic feet occupied by concrete is length multiplied by width, multiplied by depth, all in feet. Thus a single runway 60 ft. long, 2 ft. wide and 6 in. deep contains 60 by 2 by ½, or 60 cu. ft. The two runways contain 120 cu. ft. and, dividing by 27, the total volume of concrete is closely 4.5 cu. yds. The cubic yard is the unit in which ready mixed concrete is always measured.

Concrete of 1:2:4 mix is recommended for runways; this means a mixture of 1 cu. ft. cement (one bag), 2 cu. ft. sand, and 4 cu. ft. gravel. A 6-in. depth of this mix will carry ordinary automobiles and occasional fuel trucks without cracking.

One "batch" consisting of a bag of cement with the necessary sand and gravel will make 4½ cu. ft. of concrete, which is 0.167 of a cubic yard. Six such batches make a full yard (27 cu. ft.).

Spread out in the runway, a single batch will make 6.75 ft. of runway 16 in. wide, 6 ft. of runway 18 in. wide, 5.4 ft. of runway 20 in. wide, 4.9 ft. of runway 22 in. wide, and 4.5 ft. of runway 24 in. wide.

A width of 18 or 20 inches ordinarily will be found sufficient, and 16 is considered the minimum.

From these data the actual quantities needed for any width and length of single runway can easily be figured. Assuming, for example, a runway 60 ft. long, 18 in. wide, and 6 in. deep. One "batch" will make 6 ft. of length; 60 feet will, therefore, take 10 batches, or a total of 10 bags of cement, 20 cu. ft. sand, and 40 cu. ft. gravel, which, when mixed, will make 45 cu. ft. of concrete, which equals 1.67 or 1⅔ cu. yds. The two runways will require 3⅓ cu. yds.

THE easiest way to mix concrete, one might say, is to buy it ready mixed. In some cities one can buy 1:2:4 mix and have it delivered. Even if only a richer mixture is available, the saving in time and work will justify the slightly higher cost. This varies but usually is in the neighborhood of $6 or $8 a cubic yard, plus a charge for delivery. It is but little more than the materials cost and saves more than one half the back-bending work. A cu. yd. of 1:2:4

(*Continued on page 92*)

How-to-Make Kinks *for* Campers

Swinging Seat—"Tuckaway" Bed—Fire-by-Friction Set—Airplane Weather Vane—Convenient Anchor for Rowboat

YOU need not depend upon folding canvas chairs for comfortable seats when camping in the woods if you know the trick of making a swinging chair from light poles and, of course, are in a locality where there are no restrictions on cutting the necessary branches. A chair such as that illustrated at the right can be made in a few minutes from willow poles and hay wire.

The seat is supported by two tripods, which are connected by means of a tie piece at the top. The crossbars which carry the swing will remain in place almost without support, but it is better to provide blocks or pegs to hold them or at least to lash them in position. The seat itself is made of lighter poles fastened together with wire as shown so as to be comfortably flexible.—W. CLARK SANDERCOCK.

This comfortable camp chair can be built with wood cut on the spot and a few yards of hay baling wire

THE equipment of even the best-planned camp often falls short of accommodating unexpected guests. It is not difficult, however, to construct several folding camp beds and keep them on hand for emergency use.

A serviceable "tuckaway" cot for this purpose can be made, as illustrated below, by preparing legs and rails of maple, birch, ash or other hard wood and assembling them with a length of ½-in. gas pipe about 4 ft. 3 in. long, which serves as a pivot. The covering is heavy canvas about 30 in. wide. It is advisable to varnish the wood.

COULD you make a fire by friction in an emergency as did Thornton in the serial "Bare Hands," now running in POPULAR SCIENCE MONTHLY? It is always an entertaining and sometimes a very useful stunt for campers to know.

A carefully made outfit, such as Boy Scouts use for making fire by friction quickly, is not essential. Suitable materials may be found wherever there is an accumulation of forest waste, although it is not likely you will be able to make a fire in record time with them. Dried elm, birch, poplar or willow give excellent results.

The fireboard should be long enough to allow it to be held firmly with the knee or foot. Make shallow holes in it and in the handhold, as shown below. String the bow with a pliable leather thong and "make fire" by rotating the drill briskly in the center of a small heap of any dry, inflammable material, such as inner bark, wood scrapings or dry grass. When smoke appears, add a little tinder and fan gently. It is best to have a small groove running from the edge of the fireboard to the hole, so that air can be forced through it under the tinder. As soon as the tinder is afire, transfer it to a larger mass of tinder and fine kindling.

"WHICH way does the wind blow?" can be answered easily if an airplane weather vane, such as that illustrated, is doing duty upon a tall post in a summer camp or is mounted upon a boathouse, garage, barn or other building. It is a particularly attractive form of vane for a camp because the whirring propeller gives such a lively and cheerful impression.

Cut the body from a board ⅞ in. thick and fit a thin tin rudder in a slot at the tail end after tapering wood, as indicated below. Add the wing, and whittle the propeller, which is 8 in. long, from soft white pine.

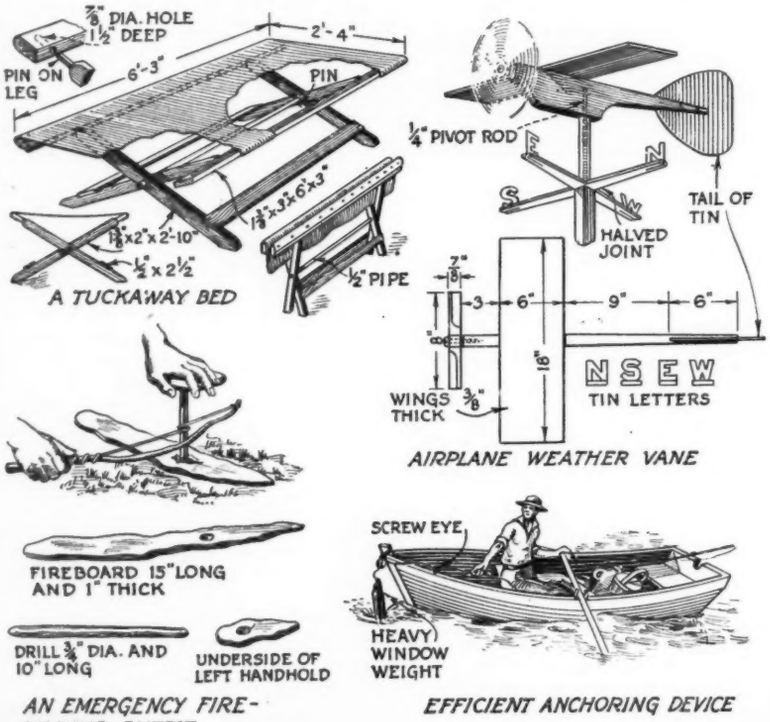
Balance the assembly upon a narrow edge and at the center of gravity bore a hole to receive the pivot pin. Insert a steel ball in the hole so that the vane will turn with little friction.

The letters are cut from tin and placed in slots in the letter arms, which are pieces of wood ⅝ in. thick, 2 in. wide at the center, 1 in. wide at the ends, and 20 in. long. They may be halved together or one may be simply laid across the other.

The whole assembly should be painted in bright colors.—C. A. K.

A ROWBOAT anchor for the purposes of a fisherman is illustrated at the left. A heavy sash weight is used as the anchor. It is tied to a length of sash cord; this is carried through a pulley attached 2 or 3 in. below the tip of the bow of the boat and through one or more screw eyes which are turned in along the inside of the gunwale. At the fisherman's or rower's seat is a cleat or screw eye to which the rope may be tied.

With this arrangement it is not necessary to get up and go forward every time the anchor has to be pulled up. Furthermore, it allows the anchor to be dropped instantly, before the boat can drift from a selected fishing place.—R. P. LINCOLN.



Details of a simple homemade folding camp cot; an outfit for making fire by friction; an airplane weather vane; method of raising a rowboat anchor from the rower's seat

Old Briar

TOBACCO

"THE BEST PIPE SMOKE EVER MADE!"

A VAST MULTITUDE OF PIPE SMOKERS instantly welcomed and praised Old Briar. Thousands upon thousands claim Old Briar to be "the best pipe smoke ever made."

The additional enjoyment, satisfaction and pipe comfort you get out of a pipeful of Old Briar costs but a fraction of a cent more than ordinary tobaccos.

Light up your pipeful of Old Briar. Let the ripe fragrance of Old Briar creep up your pipe's stem. Enjoy every bit of its full, pleasant aroma — its rich body — its extra smoothness. Notice how mild and cool it is — how completely satisfying. Then you will know why this wonderful tobacco continues to win the praise of pipe smokers everywhere.

Generations of tobacco culture, years of selecting and of testing the finest leaf tobacco, of scientific mellowing and blending, have gone into the perfecting of Old Briar. IT ALL SHOWS UP IN THE SMOKE.

TO DEALERS: Old Briar is sold in Pocket packages at 25c and Humidor boxes at 50c, $1.00 and $2.00. If your jobber has not supplied you, write us and we will send you a supply by prepaid Parcel Post at regular Dealers' prices.

IF YOUR DEALER DOES NOT HAVE OLD BRIAR

Tear out this coupon and mail to:
United States Tobacco Co., Richmond, Va. U.S.A.

SPECIAL OFFER: To make your first meeting with Old Briar an occasion for utmost satisfaction, we will mail you on receipt of this coupon and 50c the regular Old Briar 50c humidor box. In addition, we will include one 25c pocket package of Old Briar — extra — if you include your dealer's name. Send no money, but pay the postman 50c when he delivers your order. Tear out the coupon, now, while it's handy!

Your Name.....

Address.....

City and State.....

Your Dealer's Name.....

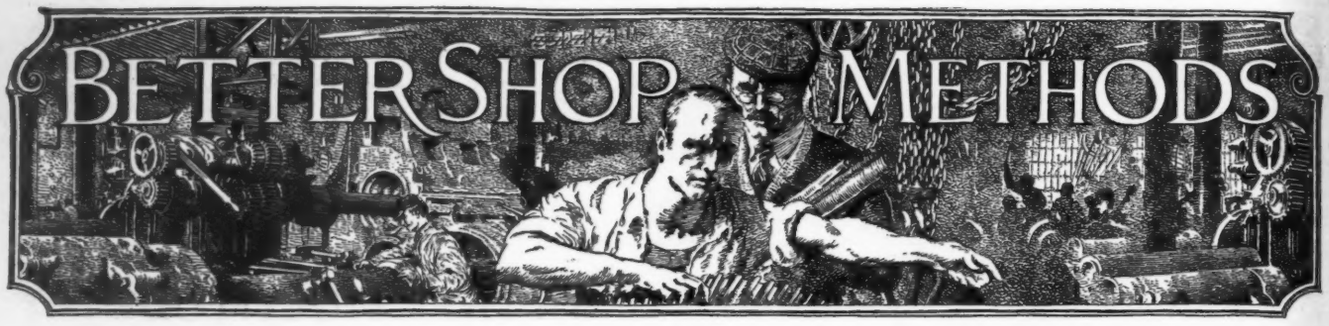
Address.....

If you prefer—send stamps, money order or check with coupon. P.S. 7

50c 25c

UNITED STATES TOBACCO COMPANY. RICHMOND. VIRGINIA. U. S. A.

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.



Hints on Using TAPS *and* DIES

Cutting Clean, Accurate Threads by Hand—Reclaiming a Jammed Bolt—Tapping Oversize—Other Time-Saving Kinks

By F. S. BROWNING

ANYONE whose mind leans toward things mechanical today realizes the great importance of proper screw threads in machine construction and repair. Truly, the modern world is held together by screw threads.

Realizing, as we do, that threaded construction is essential, what sort of screw threads shall we make? Loose fitting, ragged threads, or clean, sharp threads, true in pitch and lead, fitting snugly together and resisting vibration? Obviously the latter. Many a machine has ended at the junk heap because of poorly cut, ill-fitting threads. The vibration that ruins many a machine originates often in loosely fitting threaded parts.

Taps and dies are such commonly used articles in repair work on automobiles, tractors and farm implements that it seems strange to find many who have only a hazy idea as to their use and proper care. Also, there seems to be a great many mechanics who do not know how to get the most out of their taps and dies. Consequently these tools are subject to abuses which their importance should prevent them from receiving—in most cases simply through lack of knowledge of their proper use.

The taps most commonly used in everyday repair work are of two kinds, those for *bolt* threads and those for *pipe* threads. Hand taps for threading nuts are used to cut internal threads in which to screw bolts or other threaded parts. They sometimes are used in sets of three, taper, plug, and bottoming. These have different tapers (chamfers). The starting or taper tap has the longest taper; the following or plug tap has a shorter taper, and the finishing or bottoming tap has practically no taper.

The taper tap, with its smaller point, is easier to start in a hole, but can be used only in tapping a "through" hole such as on a nut. It is also used as a starter for the plug tap.

The plug tap is the best tap for all around use. In addition to not being very difficult to start in a hole, it has a longer threaded portion than the taper tap and can be used where it is necessary to have a thread nearly to the bottom of a "blind" hole.

A bottoming tap is used only where a thread is needed clear down to the bottom of a "blind" hole. The bottoming tap having practically no taper, cuts full size all the way and must be used after a taper or a plug tap.

Pipe taps are for cutting threads in pipe fittings into which petcocks, drain plugs, and the like are to be inserted. They generally have a taper so as to permit a steam- or water-tight joint.

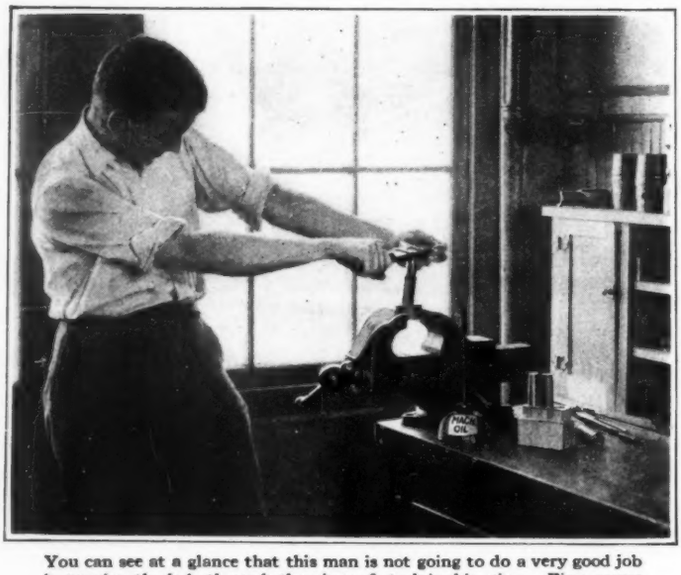
The taps most useful to have in your repair kit are a set of machine screw sizes from Nos. 1 to 14, USS, hand plug taps from 1/16 to 9/16 in. by sixteenths and from 5/8 to 1 in. by eighths, and a set of SAE taper taps from 3/16 to 9/16 in. by sixteenths and 5/8 to 1 in. by eighths.

Frequently certain taps are required for spark plugs. For the 1/2-in. size, use a regular 1/2-in. taper pipe tap which has 14 threads to the inch, and with this tap use a 11/16 in. diameter drill. For the 7/8-in. size use a special 7/8-in. tap which has 18 threads to the inch and with it use a 13/16-in. drill. For a metric spark plug you will need a tap 18 m/m diameter by 1.5 m/m pitch.

Almost everything that has been said about taps can be applied equally well to dies. Dies are of all kinds and shapes. They are used in stocks, which usually have some kind of a guide attachment. They are adjustable to size so that they can cut a little under size to allow for variation in fit as may be desired.

The solid type of die has practically disappeared from use in late years with the exception of the hexagon shaped die, which is used for rethreading jammed or rusty bolts. This is a very convenient die as it can be held in an ordinary monkey wrench (*Continued on page 106*)

What Is Wrong in This Picture?

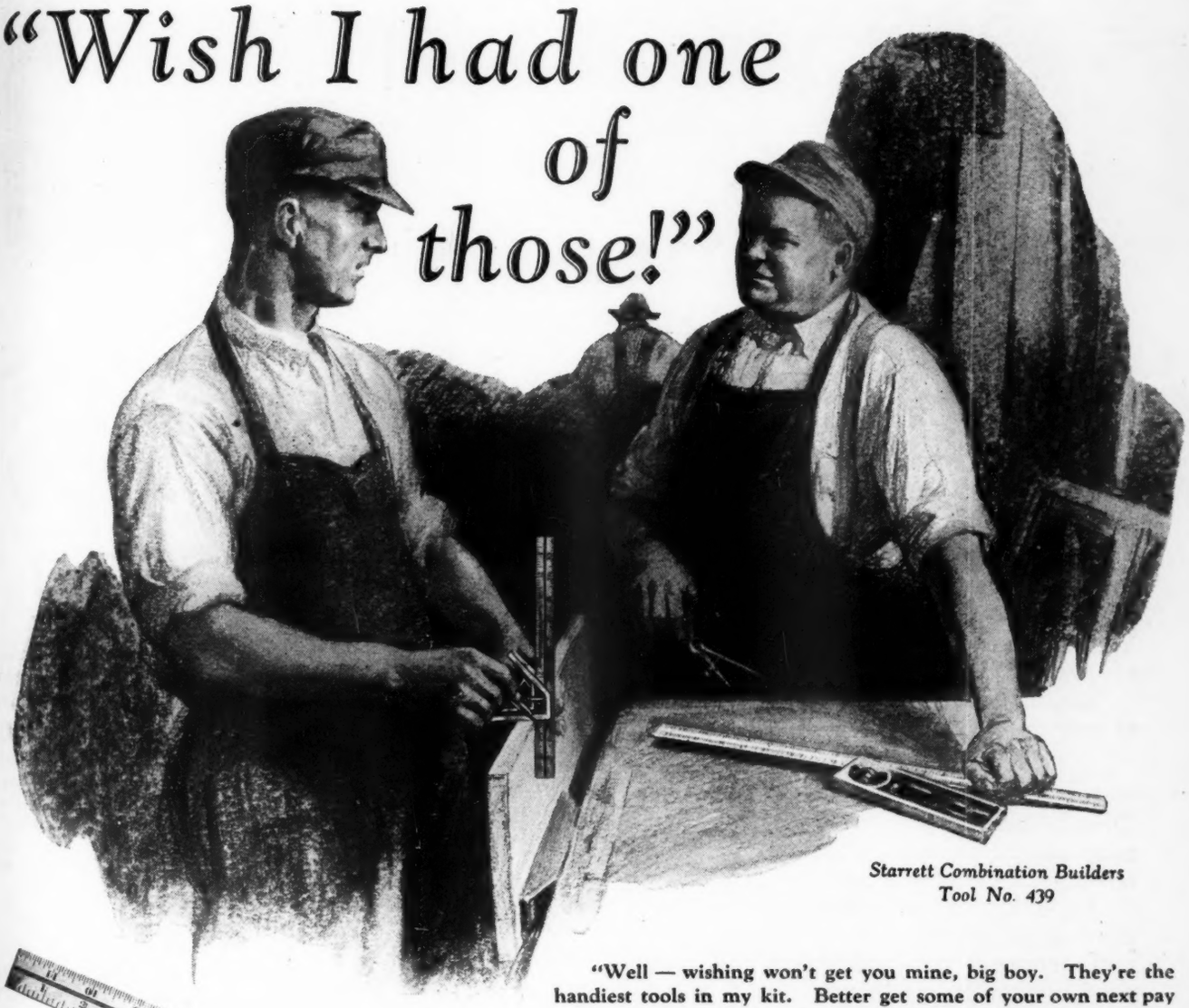


You can see at a glance that this man is not going to do a very good job in tapping the hole through the piece of steel in his vise. Five errors are indicated. See if you can name them before reading the article

---

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, to be found on pages 104 to 109.

"Wish I had one of those!"



Starrett Combination Builders Tool No. 439

Starrett Combination Square No. 94

Starrett Universal Scraper No. 194

"Well — wishing won't get you mine, big boy. They're the handiest tools in my kit. Better get some of your own next pay day — you'll wonder how you ever got along without them."

The Starrett No. 94 Combination Square is eight tools in one. It combines a Marking Gage, Rule, Try-square, Miter, Depth Gage, Height Gage, Level and Plumb.

The Starrett Combination Builders Tool No. 439 will save you a heap of figuring if you're doing any roof construction work.

Ask your tool dealer to show you these tools. Write us for free copy of Catalog No. 23 W describing over 2500 fine tools.

Starrett Universal Scraper No. 194

Here's a scraper with eight sharp cutting edges. The ends of the blade are ground square and any one of them can be brought into use by means of the ball joint.

The spring plunger makes the ball joint easy to adjust to any desired angle.

THE L. S. STARRETT CO. (IS)
World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy
ATHOL, MASS.

721

STARRETT TOOLS — STARRETT HACK SAWS CUT QUICKER LAST LONGER — STARRETT TAPES STANDARD FOR ACCURACY

Use Starrett Tools

(IS) This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Dry in 30 Minutes OR LESS

You Simply Brush It On

The fact that you never *have* painted or never *could* paint means nothing now. Rogers Brushing Lacquer is an entirely new and different proposition.

No expert ability or experience is required. Any average man or woman can use "Rogers." It isn't *painted* on. No long, careful brushing out is required. You simply *flow* it on with a full brush. Then you sort of *spread* it out.

"Rogers" forms a wonderfully smooth, satiny coating of brilliant color, *right over the old finish*. Then it

Dries while you wait!

Dries in 30 minutes or less. *Dries* free from laps or brush marks. *Dries* before dust can mar it. *Dries* in time for any urgent need. *Dries* to a smooth, porcelain-like colorful finish that wears and *wears* and WEARS. Does not *print* or gather lint.

There are scores of things in your home that will need brightening up for summer. A few are suggested on the opposite page. Try this wonderful Rogers Brushing Lacquer. See how simple it is.

There are hundreds of other uses in every home, store, office, factory and building in many industries.

Dealers everywhere now sell and demonstrate "Rogers." Comes in cans, ready for use, in 18 rich colors, also black, white and clear. To insure good results *insist upon the genuine* in the "Oriental" can . . . . the kind sold on a "Money-back" Guaranty.

DETROIT WHITE LEAD WORKS, *Detroit, Michigan*
Makers of Highest Grade Paints, Varnishes, Colors, Lacquers

ROGERS
THE MARK OF QUALITY

BRUSHING
LACQUER

Our "Money-Back" Guaranty

Try one can of Rogers Brushing Lacquer. If not more than satisfied, return what is left to your dealer. He is authorized to refund the entire purchase price

Also distributed and guaranteed by

ACME WHITE LEAD AND COLOR WORKS
DETROIT, MICHIGAN

LINCOLN PAINT AND COLOR COMPANY
LINCOLN, NEBRASKA

THE MARTIN-SENOUR COMPANY
CHICAGO, ILLINOIS

PENINSULAR PAINT AND VARNISH COMPANY
DETROIT, MICHIGAN

THE SHERWIN-WILLIAMS COMPANY
CLEVELAND, OHIO

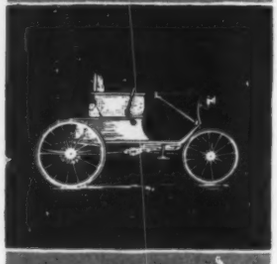
LACQUER IT
DRY IN 30 MINUTES
ROGERS
BRUSHING
LACQUER

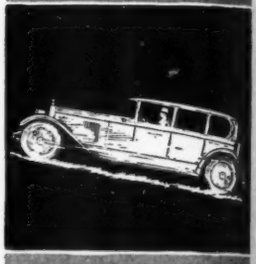
Automobiles have improved

but—

what about gasoline?

IT IS a far cry from the "horseless buggy" of yesterday to the automobile of today. But the first cars and the latest cars are alike in one fundamental respect: *both depend on gasoline for fuel.*





Gasoline is not a perfect fuel. It has always had one inherent fault. It explodes too quickly ("knocks") as temperature and compression increase.

Carbon increases both temperature and compression beyond the point at which the present day automobile is designed to operate efficiently on regular gasoline. And the full efficiency of the modern motor car and its continued development have both depended upon the discovery of a *"knockless" fuel.*

After eight years of experiment, General Motors Research Laboratories developed Ethyl brand of anti-knock compound, a chemical ingredient which leading oil companies are mixing with their regular gasoline to form *Ethyl Gasoline.*

Ethyl Gasoline is *the* efficient fuel for automobiles of today and tomorrow. This super-gasoline will give your engine a performance such as you have never known. It is available throughout the United States and Canada and is sold at pumps which display the "ETHYL" trade-mark. Try it today.

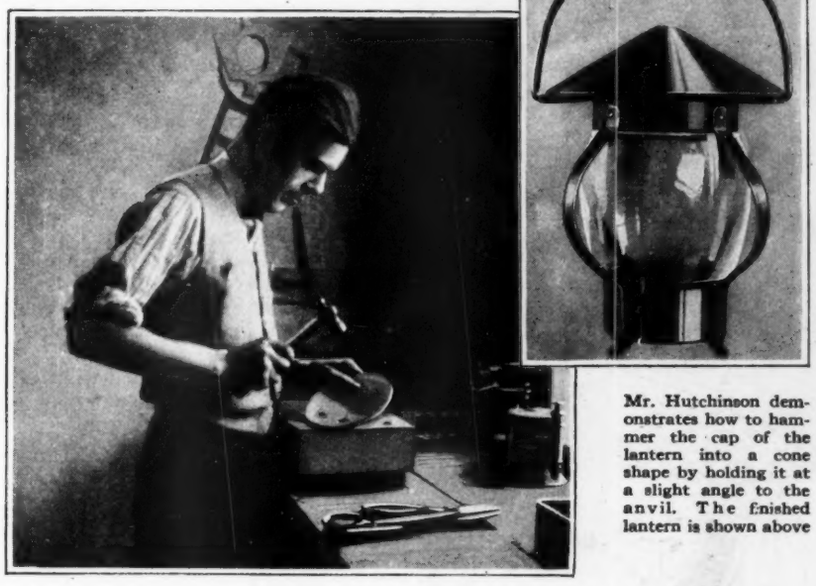
ETHYL GASOLINE CORPORATION, 25 Broadway, New York

ETHYL GASOLINE

Hammering *a* Porch Lantern

How to Make a Hanging Lamp of Unusual Simplicity and a Bracket for It—Coloring the Copper

By Dick Hutchinson



Mr. Hutchinson demonstrates how to hammer the cap of the lantern into a cone shape by holding it at a slight angle to the anvil. The finished lantern is shown above

PRICES for porch lanterns of real distinction and beauty are high. This tempts many an amateur mechanic to make one himself, but unless the method of construction is well understood, there are bound to be discouraging bumps.

For several years I have been building lanterns of many styles, but I can't make them for everyone, so I am passing along this design so that the other fellow may get a little pleasure out of making one for himself.

This lantern is really a most interesting hand hammered copper piece, and it is simple to make. The tools required are an 8-oz. ball peen hammer, an anvil or any smooth surface block of steel or iron, a vise, a pair of cutting pliers, a file, and a pair of tin snips.

Before beginning, buy at a hardware store one of the short type of ordinary barn lantern globes, which is approximately 4½ in. high over all. Obtain also a sheet of 16 or 18 gage soft copper.

To make the cap, draw a circle 7⅝ in. in diameter on the copper. Draw a line from the center to the outer edge. Then, measuring to a point 3¼ in. straight across from the outer end of the first line, draw another line to the center, and a third line ¼ in. within and parallel to the last. With the tin snips, cut out as shown in one of the accompanying drawings.

Clean up the flat end of the ball peen hammer by rubbing it over a piece of jeweler's fine emery paper until there are no scratches. Lay the cap piece on the anvil and hammer over one side only. Then turn the piece over, and, holding it at a slight angle with the anvil, hammer it carefully into a cone shape. Hold the piece slightly raised on the anvil, and work around the inside with the hammer, beginning at the outer edge and working back and forth toward the center, hammering just enough to bend, but not enough to expand the metal. Continue until the gap is closed.

Next, drill three holes in each side, and, forcing over the lap, rivet together with No. 14 brass escutcheon pins. These should be driven in from the outside, cut off close to the metal, and headed on the inside. They make very neat rivets.

The top rim should be ⅛ by 13¾ in., with four ¼-in. lugs, equally spaced, so that when the piece is formed into a hoop they will balance. Hammer this piece on one side only. Drill a hole in each of the lugs; then bend the strip into a loop. This is done by placing a bar of round iron of any size in the vise and gradually shaping the hoop over this with a hammer. The bar I use is 1 in. in diameter. Fit the hoop over the rim on the large end of the lantern globe, drill holes at each end, and rivet together.

The bottom rim, which is 1½ by 12¾ in., is made in the same manner except that it has no lugs. This should be fitted to the small end of the globe.

The base is a 3½-in. disk with four ¼-in. lugs, which should be drilled and bent down at right angles. The base should not be hammered unless it is necessary to fit it into the bottom rim tightly after having been riveted into place.

The four ribs are ½ by 9½ in. Hammer on one side only. Drill one hole ½ in. from the end of each; then, with a pair of pliers, bend the other end as is shown in one of the drawings. This is done by measuring 1 in. from the bottom end of the rib and bending over at this point. Drive down with the hammer, measure ½ in. farther, and bend back sharply to an angle of about 45 degrees. Then shape the rib with the pliers as indicated. Have the hammered side face outward.

The handle is a piece of ¼ in. round copper wire, 18 in. long, hammered all over, and bent as illustrated.

A hole should be drilled in the center of the cap large enough to admit a ⅛-in. fixture bushing, and the top filed off smoothly so that the bushing will fit down snugly.

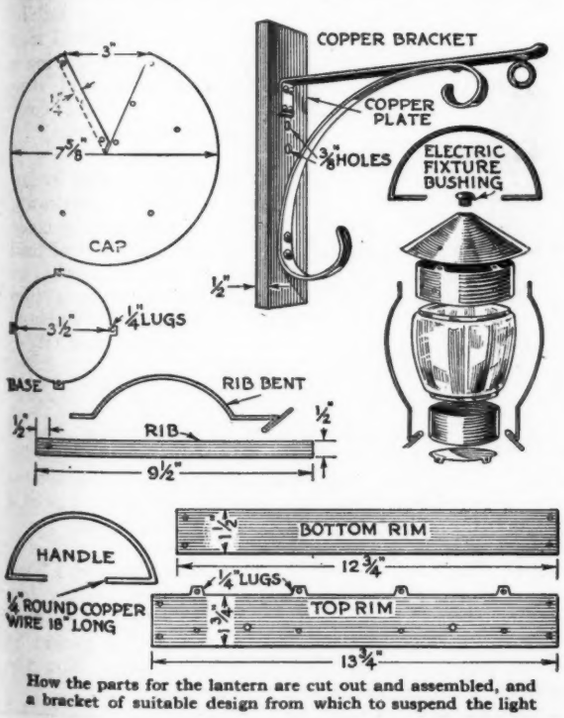
BEND the four lugs on the top rim in until they form the same angle as that of the cap. Turn the cap upside down, and set the top rim in and center it; mark and drill holes in the cap to line up with those in the lugs. Then rivet the rim to the cap with No. 14 escutcheon pins.

Center and drill four holes ½ in. from the bottom of the top rim at equal distances apart and rivet the ribs in place.

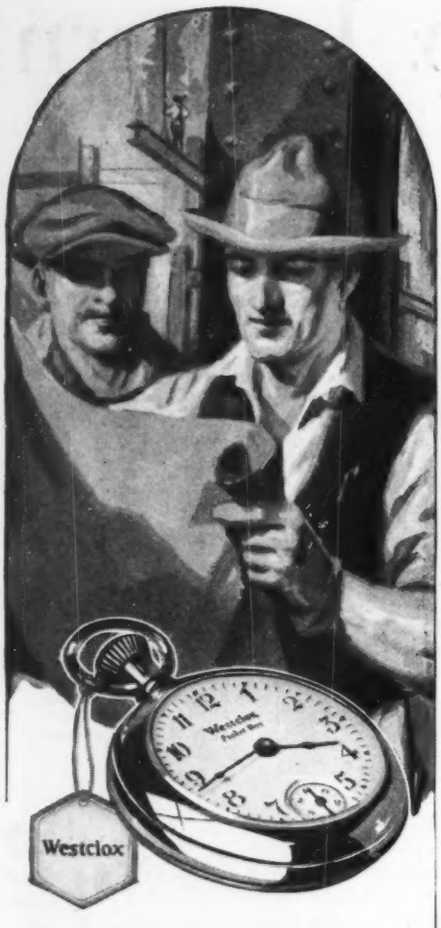
Drill a ¼-in. hole in the center of each side of the top rim, and spring the handle into these.

Center and drill holes ½ in. from the bottom of the bottom rim to correspond with those in the lugs on the base. Drive the base up into the rim until the holes line up, and rivet.

Wire a keyless (*Continued on page 86*)



How the parts for the lantern are cut out and assembled, and a bracket of suitable design from which to suspend the light



Pocket Ben

for the man on the job!

THE man on the job wants to know the truth about the time.

He needs a sturdy, steady watch—an accurate time-keeper that will stand rough-and-tumble everyday use.

Pocket Ben is that kind. Sold everywhere for $1.50. With luminous night-and-day dial, $2.25.

WESTERN CLOCK COMPANY
La Salle, Illinois

Replacing Jackknife Handles

How to Shape Them from Wood and Finish Them to Imitate Stag, Bone or Celluloid

By CHELSEA FRASER

MANY a man wears out his pockets and suffers sundry slight abrasions of his hands because a cherished pocketknife has a broken handle. Yet almost any dark-colored handle, whether celluloid, stag, bone or wood, can be duplicated successfully with the simplest tools and materials. Even light-colored handles, if made of wood, are easily replaced.

Any small scrap of wood will be sufficient for making the new handle, provided it is straight-grained and firm in texture. Maple, beech, birch, magnolia, walnut, mahogany and gumwood are suitable.

Carefully remove the broken sections by splitting them, if wood; cracking them, if bone; and softening them with a hot iron, if celluloid. Avoid reducing the length of the rivets, but file off the burred edges around their heads.

Force a strip of stiff paper over the rivets and trim to make a templet for the new handle. Plane the wood for the new handle to 1/32 in. thinner than the old handle so as to allow for reheading the rivets. Trace the templet on it, mark and drill the rivet holes, then cut out the new handle. Shape it with a knife, chisel or cabinet file, frequently pressing it in position to compare its convexity with the bolsters at the ends of the knife.

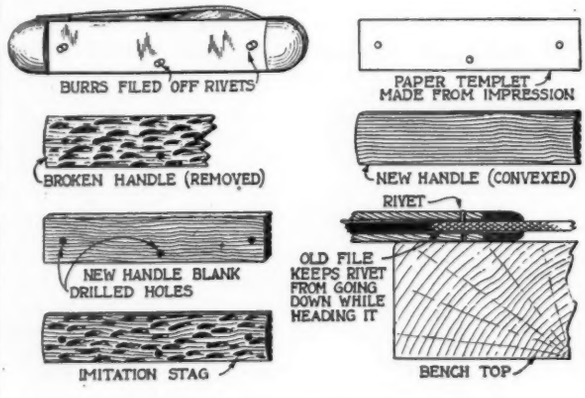
Black ink may be used to stain a new wooden handle, if followed by several coats of thin shellac

Finish with No. 1 and No. 1/2 sandpaper.

In riveting a new handle in place, insert an old mill file or several case knife blades between the brass lining plates to act as an anvil. Rivet lightly so as not to split the wood. If the rivets still project slightly, file them flush with the wood.

Smooth the new handle with No. 00 sandpaper. Use a small gouge or a leather punch to make indentations in imitation of staghorn, if necessary. Then stain the wood, rub briskly with burlap when dry, and apply several coats of thin shellac. Rub the last coat with powdered pumice stone and oil on felt.

In coloring wood, either fabric dyes or thin enamel or brushing lacquer may be used. Mottled effects may be obtained by applying a plain undercoat and stippling on a second color after the first is dry.



The steps in making a new pocketknife handle and fastening it in position with the same rivets that held the old handle

WHEN a number of irregular curves have to be drawn, a flexible ruler can be made by incasing a strip of lead about 1/8 in. thick and 1/2 in. or 3/8 in. wide in a thin rubber tube. This will hold its shape however it is bent.

Rubber Cement Mends Torn Hunting Coat Invisibly

RUBBER cement may be used for repairing tears in clothing, as I discovered on a hunting trip recently. A large three-cornered tear in a new coat was patched invisibly by turning the cloth inside out, applying a small quantity of transparent rubber cement near the edges of the tear, and covering the damaged area and cement with a small piece of cloth. A weight was placed on the cloth until the cement dried and later on, at home, a warm flatiron was run over the patch.—A. S. JAMIESON.

FOR CLEANING the bore of a pipe, I have found nothing better than a gimlet bit, which can be obtained at any hardware store for a few cents. A size should be chosen that is a trifle larger than the diameter of the bore.—A. P. A.

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

You hear compliments for Electrol everywhere . . . . In the homes of owners . . . . In offices . . . . On the street . . . . Always words of praise for this modernized oil burner.

—the most talked about oil burner in America!

In what owners say about Electrol lies the answer to Electrol's rapid rise in public preference.

Men who know fine engineering, and who have successfully heated their homes with Electrol for years, are enthusiastically recommending it to their friends.

The Master Control, found only on Electrol, is a feature you will not care to be without. This wonderful device constantly safeguards your comfort like a living sentinel watching over the burner's operation day and night. It watches the supply, the flow and the burning of the oil, and every factor of Electrol's all-electric, entirely automatic operation.

Ignition is instantaneous and positive. No gas pilot light is needed. The oil is atomized into a fine mist and ignited directly by electricity. Low air velocity insures extremely quiet operation.

Regardless of the type of heating plant in your home, Electrol will economically add comforts, conveniences and heating certainty, worth many times its cost.

Send for this book

"The Master Furnace Man" is an enlightening book containing much valuable information on the proper selection of an oil burner. Call on the Electrol dealer in your locality. He will gladly make a conscientious study of the heating requirements of your home, without charge—and explain the attractive Electrol budget payment plan.

Listed as Standard by the Underwriters' Laboratories, and bears its label. Approved by the New York City Board of Standards and Appeals—and by the Commonwealth of Massachusetts Department of Public Safety.

ELECTROL INC. of Missouri
180 Dorcas Street, St. Louis, U. S. A.

ELECTROL INC., of Missouri, 180 Dorcas St., St. Louis, Mo.
Gentlemen: Please send me a copy of your book, "The Master Furnace Man." I am interested in Electrol, the Oil Burner with *The Master Control*.

Name.....
Address.....
City.....
State.....

ELECTROL

The OIL BURNER with *The Master Control.*

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Pipe Smoker Finds the Right Tobacco for the Tropics

Evidently, one of the problems of pipe smokers who live in the tropics is to find a tobacco that high temperature will not spoil.

Mr. R. G. Rigg of Colombia, S. A., was happy to find that he could enjoy in South America the same tobacco that had been his favorite since 1908 when he lived in Iowa.

His letter follows:

October 6, 1926

Larus & Bro. Co.
Richmond, Va., U. S. A.

Gentlemen:

Most all well-known tobaccos smoke well in a cold or temperate climate, but very few in a tropical climate. They are mostly too heavy, don't seem to be blended right—at least that is my opinion gained from practical experience.

However, Edgeworth is the same in any climate. Again that is my opinion gained by practical experience.

I cannot get the same pleasure out of any brand of tobacco that I can out of Edgeworth, and I have tried many—and paid fancy prices too. It costs real money to smoke imported tobaccos here; the import duty is very high.

Anyway, we cannot have everything we would like in these countries, so we hold on to all the little pleasures possible. Now you know why I smoke Edgeworth.

Yours respectfully,
R. G. Rigg,
Cartagena, Colombia, S. A.

Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it, for it never changes in quality.

Write your name and address to Larus & Brother Company, 10 S. 21st Street, Richmond, Va.

We'll be grateful for the name and address of your tobacco dealer, too, if you care to add them.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidors holding a pound, and also in several handy in-between sizes.

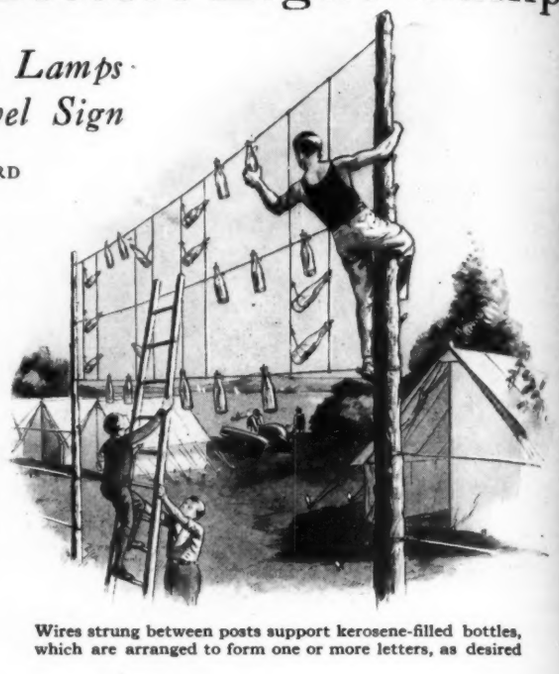
To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice of Edgeworth Ready-Rubbed for the same price you would pay the jobber.

On your radio—tune in on WRVA, Richmond, Va.—the Edgeworth Station. Wave length 256 meters.

Flaming Letters Light Camp

Bottles Used As Lamps in Making Novel Sign

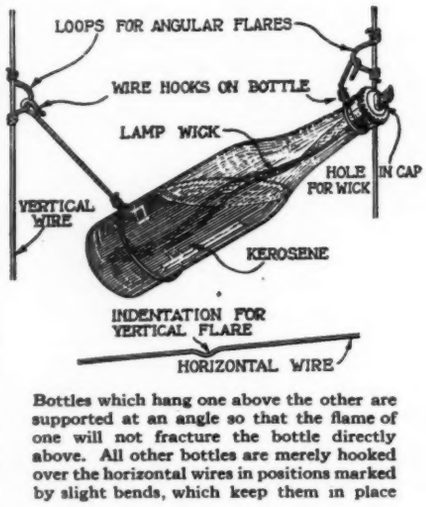
By J. V. Hazzard



Wires strung between posts support kerosene-filled bottles, which are arranged to form one or more letters, as desired

JUD TOLSON bolted his supper and fell to rummaging through his dunnage chest, whistling the while. His search produced cold chisel, hammer, pliers, a small lamp wick, and a length of 1/16-in. iron wire. The litter under his tent yielded an ordinary pop bottle and, after a search, a top for it. This he laid on the tent floor, slotted with the chisel and threaded with the lamp wick, after turning and pounding down the rough edges of the cut. Kerosene to half fill the bottle he poured, with a grin, from his neighbor's lamp. A hook for hanging he accomplished by twisting a piece of wire snugly, but not tightly about the bottle neck, bending a hook in the end left projecting for that purpose.

Darkness fell before the job was finished. Jud hung the completed flare on his wire clothesline and touched a match to the wick. There was a small light, accompanied by a heavy black smoke; then a long waving tongue of flame lit the whole back of the tent.



Bottles which hang one above the other are supported at an angle so that the flame of one will not fracture the bottle directly above. All other bottles are merely hooked over the horizontal wires in positions marked by slight bends, which keep them in place

"Hey! What the hunk you doing!" yelled a voice from the next tent. Jud's invitation to come and find out was interrupted by the arrival of half the camp, bucket in hand, for tents have a habit of burning with surprising alacrity and seasoned campers know the folly of hesitation.

Order being restored and the flaming bottle deposited at a safe distance, Jud found opportunity to explain his plan.

Opening night found the Crescent Canoe Club fairly buzzing with life and color. Canoes came and went, sporting new fittings, new varnish and new ladies. Music floated across the water from the mess tent where the floor had been cleared for dancing. Flags and Jap lanterns festooned tents and trees. Darkness came slowly and softly. With it came a fusillade of shots from a line of figures dimly outlined along the water front. At the far right a torch flared, then another, and another, until there blazed against the blackness a tremendous "C." There followed the crash of another volley and "R" flamed, a bit smokily at first and then steadily. Volley followed volley and letter after letter the name of the Club appeared, outlined in flaring letters across the eighty-foot frontage of the camp. A long round of applause followed by a rush for the canoes signified the appreciation of the guests. The view from the river proved even more striking.

"But, how did they do it?" Even the old-timers along the river asked the question.

Morning found the curious gazing at a peculiar arrangement of tall posts and tightly strung wires. To the rustic fence fronting the camp were secured 8-foot posts spaced at 10-foot intervals, the tops being joined by tightly stretched wire; 2 feet below this stretched another wire and 2 feet below, another. The three parallel strands were joined with lighter pieces on which appeared loops at regular intervals.

"That's what the lights hang on all right," observed one, "but where and what are the lights?" It goes without saying that no one guessed, but when, a week later, the sign made its reappearance in honor of the Commodore's birthday, the Crescents were obliged to tell the story of "Jud's blaze of glory" to several score enthusiastic and envious campers.

A deal of planning had been necessary. Where flares hung (*Continued on page 85*)

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Flaming Letters

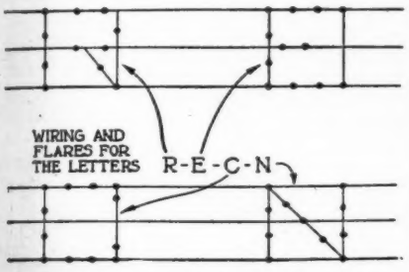
(Continued from page 84)

perpendicularly one above the other it had been found necessary to guy them out to a supplementary wire as indicated, else the heat from the lower flares fractured those above.

Originally the flares were placed at 8-in. intervals, but later it developed that 12-in. intervals produced just as satisfactory results and effected a considerable saving in fuel and labor. Letters 3 ft. high, with a corresponding saving in flares, would be large enough in many instances. Indeed, the suggested arrangement illustrated below is based upon 3-ft. spacing rather than the 4-ft. letters used for the canoe club sign.

It was found that the sign would burn 14 hours continuously, or two evenings from dusk to midnight without refilling. Two miles away the sign was easily readable, having all the appearance of an electrically lighted affair.

Once in use the flares served various purposes. The landing float, projecting some twenty feet from shore, had been rammed occasionally by motor boats and



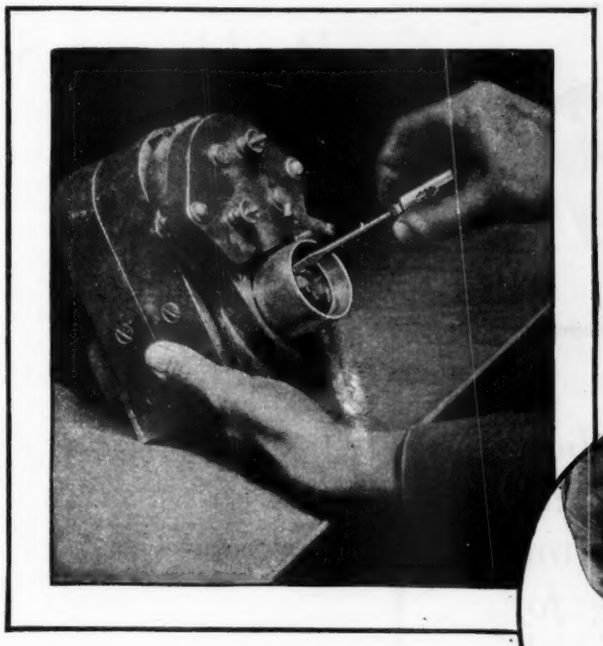
Method of spacing bottles for letters 3 ft. high. The flares are placed 12 in. apart

unwary canoeists, so it became the practice to light the outer corners with lanterns. In one way or another we managed to kick one or other of these overboard about once a month. With the advent of the flares a hole was cut in the decking of the float just over the beam forming the front member of the framework at these corners and, with its bottom resting on the beam and neck and top projecting a scant 4 in. above deck, the flare served all purposes.

They also proved valuable in lighting up dark corners where illumination without brilliant light was desirable and two or three judiciously hung about the camp site before turning in for the night assured sufficient light to distinguish inquisitive prowlers from members of the club.

Preparing Ground Glass in an Emergency

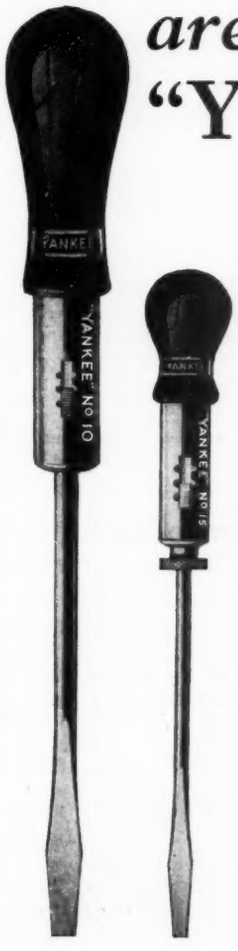
WHEN a small piece of ground glass is required, as to replace the ground glass of a camera, and the commercial product cannot be easily or immediately obtained, it is possible to prepare a piece of plain glass by rubbing it with fine emery paper lubricated with a few drops of thick oil. By bearing down on the glass with moderate pressure and adding oil from time to time, one can prepare a small plate with relatively little effort.—L. D. S.



While left hand holds work, and right hand holds driver steady, you start screw with thumb-turn on blade.

Pesky little screws are easy with

"YANKEE" No. 15



FOR with this handy Ratchet Screw-driver you can start wobbly screws quickly by revolving Knurled Washer with thumb and forefinger.

Then you send screw home in a jiffy by Ratchet Movement. How simple—how useful!

Right and Left Ratchet, and Rigid. Saves time and strength. Ask your dealer to show you the "Yankee" Ratchet Screw-driver.

No. 15—With "Yankee" thumb-turn on blade. Ratchet shifter moves lengthwise. Six sizes: 2 to 8-inch blades.

No. 10—Without thumb-turn. Eight sizes: 2 to 12-inch blades.

No. 11—Same as No. 10, except ratchet shifter moves across tool.

Some Other "Yankee" Tools

Plain Screw-drivers	Automatic Push Drills
Spiral Screw-drivers	Automatic Feed Bench Drills
Ratchet Bit Braces	Ratchet Tap Wrenches
Ratchet Breast and Hand Drills	Vises—Removable Base

Dealers Everywhere Sell "Yankee" Tools

"Yankee" on the tool you buy means the utmost in quality, efficiency and durability.

FREE
New "Yankee" Tool Book

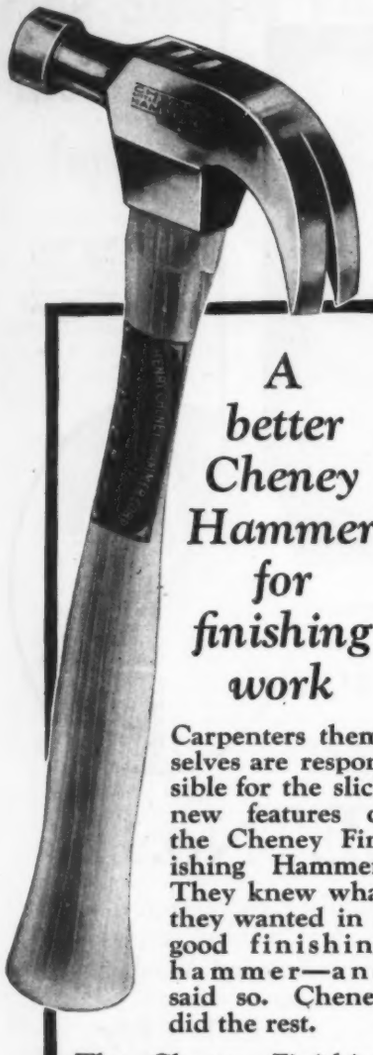
This interesting little book is for all lovers of fine Tools. It tells just what you want to know about all the famous "YANKEE" Tools for making work easier and quicker.

NORTH BROS. MFG. CO., Philadelphia, U. S. A.

"YANKEE" TOOLS

Make Better Mechanics

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.



A *better Cheney Hammer for finishing work*

Carpenters themselves are responsible for the slick new features of the Cheney Finishing Hammer. They knew what they wanted in a good finishing hammer—and said so. Cheney did the rest.

The Cheney Finishing Hammer has the same fine Cheney tool-steel head that's been tempered to stand the gaff and the same wonderful Cheney "hang" that means a whale-of-a-lot to a man at the end of the day's work. Added to these features is a new, slender, second-growth hickory handle with a real spring in it. It rebounds from finishing work without marring it and actually fits in a man's hand with honest comfort.

Your first job with a Cheney Finishing Hammer will tell you the story better than we can. Try one.

PRENTISS VISES
PRENTISS VISE CO.
106-110 LAFAYETTE ST. NEW YORK CITY
CHENEY HAMMERS

935

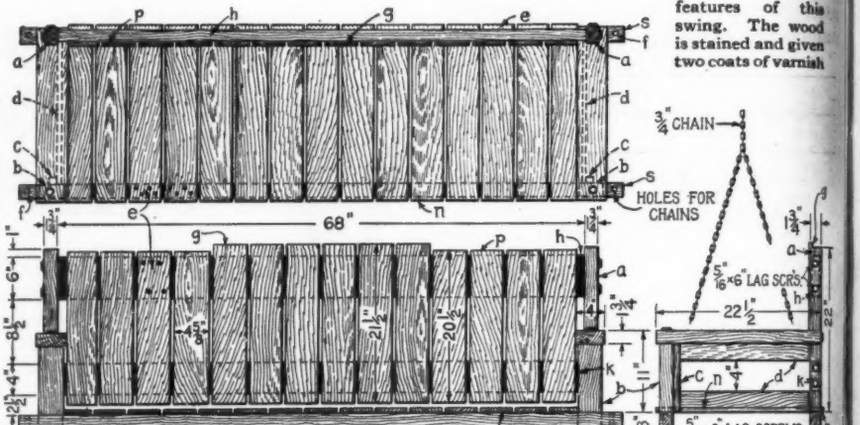
Building a Sturdy Porch Swing

IN MAKING this porch swing, it is essential to use oak or some other hard, strong wood. The stock may be cut to the following thicknesses and widths and dressed at a woodworking mill.

Two bottom rails 1¾ by 3 by 78 in., one back rail 1⅜ by 6 by 68 in., one back rail 1⅜ by 4 by 68 in., two back posts (a) 1¾ by 1¾ by 22 in., and two front posts (b) 1¾ by 3½ by 9¼ in., two arms 1¾ by 4 by 22½ in., two furrings (c) ⅞ by ⅞ by 9¼ in., four cushion supports (d) ½ by 2⅝ by 19 in., or use only two and make them 4 in. wide (verified for length), and fifteen seat slats ½ by 4½ by 23 in., eight back pieces ½ by 4⅝ by 20 in. and six ½ by 4⅝ by 21½ in. Eight lag screws $\frac{5}{16}$ by 6 in. and twelve $\frac{5}{16}$ by 5 in., with washers; 2 lbs. fourpenny nails; chain; stain and varnish.

The nails should be staggered as indicated (e) to avoid splitting. The chain holes (f) should be bored with a ¾-in. bit.—C. K.

Straight lines and simple construction are the main features of this swing. The wood is stained and given two coats of varnish



Top, front and end views of the swing, which is assembled entirely with lag screws and nails. All sharp corners of the frame are planed off and the seat corners rounded before assembling

How to Hammer Out a Porch Lantern

(*Continued from page 81*)

porcelain socket with weatherproof wire, and slip the wire up through the bushing in the top of the lantern. Screw the bushing into the top of the socket. Allow enough wire to reach from the lantern, through the bracket, and to the outlet box for attaching to the service wires.

Slip the large end of the globe into the top rim, place the bottom rim over the small end of the globe, and spring the ribs into place over the edge of the bottom rim, and the lantern is complete.

The bracket illustrated is a simple one to make. The plate is cut from the same stock as the lantern—5 by 14 in. A ½-in. square is cut out of each corner and the piece is bent up into a box shape. A ⅜-in. hole is drilled through the center for attaching to the outlet box, and above this, another hole is drilled to admit the wires.

The arm and bracket are made of ⅛-in. copper, 1 in. wide, and riveted together and to the plate with escutcheon pins. The ring is an ordinary fixture loop, held in place by a ⅛-in. hexagon fixture burr.

The whole piece may be left a copper or natural color, or, if desired, a permanent reddish brown may be obtained by heating the finished metal slowly with a blowtorch. Care must be taken, however, not to overheat it or a scale will form and spoil the effect.

A verd green seems to be the most popular finish. To produce this, mix about 5 oz. commercial nitric acid in 1 qt. water in a glass or earthen bowl. Immerse the pieces to be colored in this solution, remove immediately, and hang up where they can remain for five or six days. This formula is worth remembering, as I spent a lot of time and money before I finally succeeded in producing a satisfactory verd green. It works equally well on brass and copper.

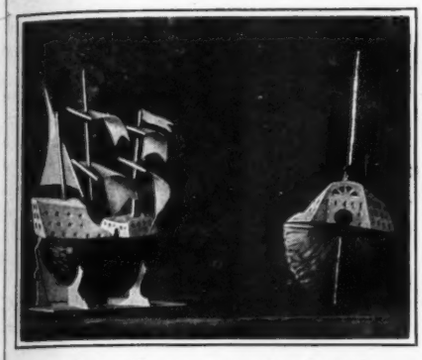
With any of the above finishes, it is well to go over the entire piece with a good floor wax; this will preserve the finish and resist the weather.

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Tiny Decorative Galleon Has Walnut Shell Hull

THE galleon illustrated is made of a walnut shell with toothpick spars and stiff brown wrapping paper sails. Forecastle and poop are of writing paper, and deck, keel, cradle and base are from a correspondence card. Gilt borders and designs from Christmas cards, pieces of cigar bands and the brilliant tissue paper lining of envelopes furnish material for the decorative touches, figurehead and banners. No rigging is necessary.

The half shell is turned open side down on the correspondence card while a light pencil line marks the shape of the deck, which is then cut out and glued in place. Cutting the keel is a case of fit and try; the cradles are formed the same way.



A walnut galleon on a stand and another about ready to set sail in an aquarium

These are glued to the hull and the base attached to the cradles.

The decks and sides of forecastle and poop are made in one piece; the ends are separate pieces. Masts and bowsprit are stepped by poking needle holes through superstructure and deck and forcing the toothpicks through the holes.

Sails are cut and glued to the spars before the latter are attached to the masts and, after the glue has set, are given a realistic curve by rolling around a pencil. Ladders leading to the poop deck may be marked off with black ink and the rudder post is represented in the same manner.

With the addition of a half dozen bird shot for ballast and a coat of shellac, a nut shell galleon will ride the waves of an aquarium.—J. V. H.

How to Lock a Dial Telephone Against Unauthorized Use

Padlock prevents dial from being turned

TO PREVENT unauthorized calls being made on a dial telephone, especially one located in an office and accessible to anyone after business hours, the instrument can be locked by using a light padlock as shown. In one large office this has reduced the telephone bills $50 a month. The phone may still be used to answer incoming calls.—IRVING L. HOLLANDER.

Men Are Changing

By Scores of Thousands

From old-type shaving soaps to this unique creation—let us send you 10-day tube to try

GENTLEMEN:

80% of the present users of Palmolive Shaving Cream once were wedded to rival preparations. Millions have discarded old-type shaving soaps for it.

We won them over by giving them liberal test tubes of this unique creation to try. Then asked them to compare with present favorites.

Now we seek a like opportunity of proving results to you.

We believe you'll find that 5 major mistakes in shaving preparations have been corrected. And shaving thus given a new element of comfort, speed and pleasure.

These 5 advantages

1. Multiplies itself in lather 250 times.
2. Softens the beard in one minute.
3. Maintains its creamy fullness for 10 minutes on the face.
4. Strong bubbles hold the hairs erect for cutting.
5. Fine after-effects due to palm and olive oil content.

Let us prove this

We ask your permission to prove these things—to send you a tube to try. We are masters of soap making. One of our soaps—Palmolive—is the leading toilet soap of the world. We have worked hard to excel in a Shaving Cream. We made up and tested 130 formulas before we attained our ideal.

Do us the kindness to mail this coupon, for your sake and for ours.

THE PALMOLIVE-PEET COMPANY, CHICAGO, ILL.

To add the final touch to shaving luxury, we have created Palmolive After Shaving Talc—especially for men. Doesn't show. Leaves the skin smooth and fresh, and gives that well-groomed look. Try the sample we are sending free with the tube of Shaving Cream. Here are new delights for every man. Please let us prove them to you. Clip coupon now.

10 SHAVES FREE

and a can of Palmolive After Shaving Talc

Simply insert your name and address and mail to Dept. B-1335, Palmolive, 3702 Iron Street, Chicago, Ill.

Residents of Wisconsin should address Palmolive, Milwaukee, Wis.

.....

.....

(Please print your name and address)

3616

"Give Me A Cigar, Please"

You don't hear men ordering cigars that way—not if they know anything about them. They know the kind they want and ask for it.

The same can be said of tools. When you ask your dealer for a TRIMO wrench, he realizes that you know good pipe tools. For the name *TRIMO* has won respect wherever such tools are used.

The man who specifies TRIMO gets more than "just a wrench." The pressed steel frame of a TRIMO never breaks. TRIMO'S jaws are renewable. Sharp new jaws can be inserted when the old ones get dull. The nut guard keeps a TRIMO from being knocked out of adjustment. TRIMO users know that these features are worth demanding.

If you want a pipe wrench or monkey wrench, let it be known you want a *TRIMO*. But don't keep it secret. Always specify *TRIMO*.

TRIMONT
Manufacturing Co.
ROXBURY (Boston), MASS.
America's Leading Wrench Makers for Nearly Forty Years

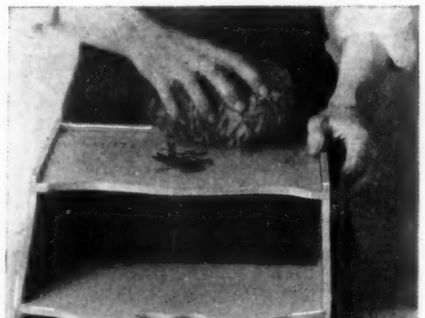
How to Apply Art Transfers

(*Continued from page 73*)

more formal decorative work. Other classifications from which one can choose are *conventional* designs, which are for the more formal pieces; *oriental* designs resembling the work of Chinese and Japanese artists, especially desirable for red or black lacquered radio cabinets, secretaries, chests, telephone stands and so-called occasional pieces in oriental color schemes; *landscapes*, for rather ornate painted furniture in period designs, and *Colonial* designs, which are now enjoying great popularity.

If you decide which of these classifications is most appropriate for the piece you wish to decorate, you will find the process of choosing appropriate transfers will be much easier than if you make a hasty and haphazard hunt through the large variety of samples of all these types which you will be shown in any well-stocked shop.

In addition to these classifications, there is another type of transfer intended especially for use over natural finished furniture, which gives the effect of inlaid bandings and inserts. So perfect are some of these that it is almost impossible to tell them from actual inlays, although they can be obtained for a fraction of the cost and require none of the skill which genuine inlaying calls for.



The surface is cleaned first with clear water, then with gasoline diluted with water

When you have decided upon the type of design you wish, make up your mind as to the approximate size. It should be proportionate to the surface on which it is to be applied. The tendency is to select a design that is too small. The shape, too, should correspond to the surface on which the transfer is to be used.

Your good taste will govern in selecting the coloring. If you can take a small sample of the background color with you when buying transfers, it is a simple matter to choose.

SOME articles can be decorated with almost any type of pattern. A magazine rack, for instance, would be in good form decorated with any motif with the exception, perhaps, of fruit. Breakfast sets are generally done with four corner designs. Card tables and other small tables often have a central design combined with corner pieces and occasionally a narrow border is run entirely around the table top or connected with the corner designs. Lineal borders are obtainable for this purpose in 2-ft. lengths.

You will find that the back of each transfer usually is marked with vertical and horizontal guide lines. These are to aid you in centering the design and applying it exactly horizontal or vertical. If there are no guide lines, trim the top of the transfer paper to a straight edge just above the design and mark the vertical center line.

Make careful measurements before applying transfers and do not rely merely upon your eye. The best design will not be satisfactory if off center or crooked.

A THIN, quick-drying varnish is an ideal adhesive for transfers, as it is elastic and does not cause puckering. The various proprietary adhesive cements made on a varnish base also are usually excellent. A good grade of liquid glue is often used by home decorators because it is so convenient; its adhesive properties are entirely satisfactory, but there is some tendency for glued transfers to draw and pucker up while drying.

Apply a thin, even coat of the adhesive selected to the face of the transfer, covering every bit of the design. Allow to stand until the adhesive is "tacky" or sticky. Place the transfer on the surface to be decorated and rub down hard with a cloth or, preferably, with a rubber roller such as is used for mounting photographs. Work from the center outward to avoid wrinkling.

Next saturate the paper backing with lukewarm water. Wait about thirty minutes before doing this, however, if glue has been used as an adhesive. If any air bubbles are seen after applying the water, smooth them with the roller. Then lift or slide off the paper backing.

Clean the surface immediately by sponging with water. In case the transfer has been applied with varnish, the water will not remove surplus deposits of varnish, so go over the entire surface a second time with gasoline diluted about 50 per cent with water. No hesitation need be felt in doing this if the surface, whether paint, enamel, lacquer or varnish, is thoroughly dry, as it will not appreciably affect its appearance. Even should the finish become streaked for any reason during the application of the transfers, it can be polished with furniture polish or wax to restore the luster.

It is important to wash up the surface at once after removing the paper backing because the gum remaining on the face of the transfer is otherwise almost certain to pucker and crack the design.

Even the best transfers sometimes seem a bit temperamental and occasionally can may go wrong, but if reasonable care is used, there will rarely be any difficulty.

If one has had any experience in art work or decorative painting, it is often possible to touch up designs with artist's oil colors so as to (*Continued on page*

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

How to Apply Transfers

(*Continued from page 88*)

bring out the high lights and shadows and tone down or change the colors, where necessary, to bring the design more in harmony with the body color. If well done, this makes the design appear wholly hand painted. It is frequently resorted to by professional furniture decorators.

Whether a protective coat of varnish should be applied over the transfers depends upon the individual piece, how it will be used, and the effect desired. If it is going to have any hard wear over the decorated surface, as, for instance, in the case of a breakfast table or the back of a chair, the transfer must be protected; otherwise the hand-painted effect will be most fully preserved by leaving the transfer uncoated.

VARNISH, when used as a protective coating, is generally applied with a small brush, following the outline as closely as possible. This gives a glossy luster to the design and changes the effect considerably. Clear brushing lacquer may be used and, as it has not so high a gloss, gives a more artistic effect than varnish; indeed, it is an ideal coating for this purpose. Clear lacquer does not, as one might expect without trying it, "pick up" the transfer colors or cause them to "bleed." Flat varnish also may be used; it dries without gloss, but has little wearing qualities.

Sometimes a pleasing effect is obtained by coating the entire surface of lacquered articles with clear lacquer. One should make sure of the effect in advance, however, by trying a small sample, as this treatment will change considerably the appearance of a colored lacquer finish. If the piece had been finished with enamel instead of colored lacquer, do not conclude that varnish can be similarly used over the entire surface, because it gives a distinctly yellow tone, especially over light and delicate tints.

After making a few experiments with decalcomania transfers, you will find you have at your command one of the most inexpensive and attractive methods of decoration ever developed for furniture and craft work.

Painted Glass Checkerboard

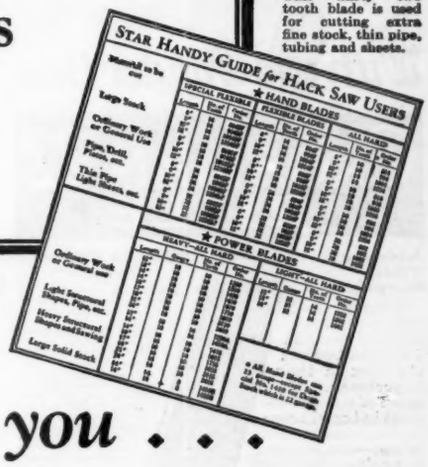
TO MAKE a glass checkerboard, cut a piece of plate glass 14 or 15 in. square, grind the edges smooth with emery powder moistened with turpentine, mark off a border of 1 or 1½ in., as the case may be, and divide into 1½-in. squares. Paint the squares alternately black and red, and the border any color desired. Then mount the glass, painted side down, in a small table or any suitable frame.

AMATEUR woodworkers sometimes have to glue up furniture that is too large for such cabinetmaker's clamps as may be available. If two pairs of iron bar clamps of either the 3 or 4 ft. length are at hand, it is a simple matter to drill ⅜-in. holes through them at intervals and bolt them together in pairs to make double size clamps.

Free

A Star Hack Saw Blade and this Chart free if asked for on a business letterhead

A ten-tooth power blade for cutting machinery steel, large angles and big stock.
An eighteen-tooth hand blade, a good all-round saw for general work.
This thirty-two tooth blade is used for cutting extra fine stock, thin pipe, tubing and sheets.



This chart in full size in two colors shows the proper hack saw blade to be used in cutting operations.

Our offer to you . . .

THE best salesman for Star Blades are the Blades themselves.

Recognizing this we will send *free* a Star Blade and above chart, full size, in two colors to any reader of Popular Science Monthly asking for them on their business letterhead.

We make this liberal offer as we know that if you once use Star Blades in your plant you will be a regular buyer.

Since 1883—for 45 years—we have concentrated on the efficient and economical production of hack saw blades on a volume basis. This concentration has resulted in the production of a hack saw blade that eliminates the great waste of breakage . . . a blade that will do the toughest work. Star blades have gained their prestige by reliable, dependable performance.

5 points of the Clemson Star

1. CLEMSON EXPERIENCE . . . 124 years of the combined experience of the Clemson Family.
2. CLEMSON STEEL . . . Special Tungsten Steel made to exact specifications and correct manufacturing processes.
3. CLEMSON TEETH . . . . The correct angle and rounded gullet of the teeth give them the maximum cutting ability, strength and endurance.
4. CLEMSON SET . . . . The teeth are set in a manner to maintain the proper clearance, to keep the cut free of chips.
5. CLEMSON TEMPER . . . . The heat-treating methods used give STAR Blades an extraordinary degree of strength, toughness and uniformity.

Every STAR Blade is branded with a STAR

TRADE MARK

HEADQUARTERS for HACK SAW BLADES Since 1883
CLEMSON BROTHERS, INC.
MIDDLETOWN, NEW YORK

STAR HACK SAW BLADES

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Try Shooting as a Relaxation

With the Wonder Gun

The CROSMAN .22 RIFLE

Accuracy That Surprises

Even seasoned sharp-shooters find this new gun accurate beyond anything in their experience. Absence of powder-deposit in barrel keeps it true, from first shot to last—like shooting a newly-cleaned gun every shot. Put bullet after bullet through same hole. Establish new high records and astonish your friends.

Never Needs Cleaning

Powderless, smokeless, noiseless. Never needs cleaning—every bullet passing through barrel acts like swab — leaves it brighter and cleaner. Shoot all day, then put gun away and rest while your friends mess with oily, blackened rags. Next day out-shoot them again with your wonderful Crosman.

"Power Without Powder"

Enjoy the pleasures of target shooting on your picnics, camping or outing trips.

Have a shooting gallery in your yard, apartment, cellar. Feel the thrill of the bull's eye —ping! ping! ping!—three, four, five perfect shots. The Crosman .22 rifle can be fired anywhere—needs no cleaning—accuracy unsurpassed—makes no noise—and the ammunition costs so little the saving soon pays for the gun.

Here's the most remarkable gun that has appeared for years—a .22 rifle that uses no powder, has accuracy not obtainable in any other gun, abundant power, never needs cleaning, is silent and scientifically correct.

The delight of manwhoglory in precision shooting and the ownership of a handsome, powerful gun.

FREE *Target and Game Shooting*

Send for Free Booklet Now

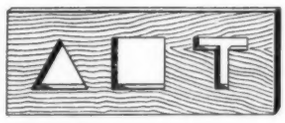
Complete illustrated. Shows new-shaped bullet—explains superior accuracy—tells why saving in ammunition soon pays for gun—quotes Crosman feats that delighted owners—pictures penetration tests—reveals novel features—lists exclusive Crosman advantages, etc. Postal brings it. Write now.

CROSMAN ARMS CO.
412 St. Paul St.
ROCHESTER, N. Y.

A Square Peg in a Round Hole

By Arthur L. Smith

CAN you whittle a single block which will exactly fill each of three holes cut in a strip of wood as shown at the right? The plug must fit in such a way that it can be pushed right through any one of the holes.

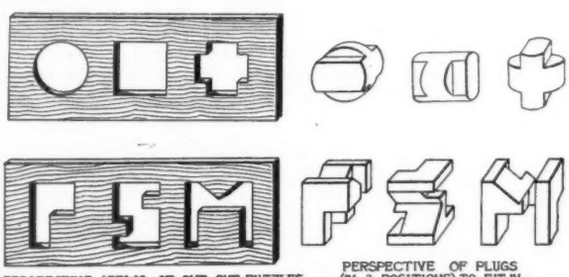


A single block or plug can be whittled that will fit accurately all of these holes

The openings are cut in a flat strip of cigar-box wood or thin 3-ply stock 2 by 5 in. The triangle has a base and altitude of 1 in., the square is 1 in., and the T measures 1 in. each way. The plug which will fill these holes will be illustrated in the August issue.

This puzzle is similar to the very old one of the circle, square and cross, which is also illustrated. The problem, indeed, can be varied infinitely. Letters may even be used as in the PSM (Popular Science Monthly) puzzle shown. In this example the letters are 1¼ in. high. Most three-letter initials could be treated similarly.

The solution of these puzzles depends upon the fact that a solid has three dimensions: in one it may take the form of a circle, in another it may be a square, and in another, a Greek cross or other figure.



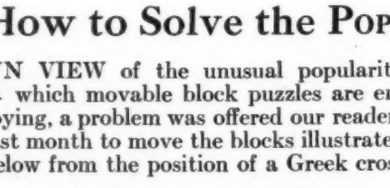
PERSPECTIVE VIEWS OF CUT-OUT PUZZLES. EACH PUZZLE TO BE FITTED WITH A PLUG THAT WILL FILL THE THREE HOLES.

PERSPECTIVE OF PLUGS (IN 3 POSITIONS) TO FIT IN EVERY HOLE OF THE CORRESPONDING CUT-OUT PUZZLES.

Two puzzles of the plug-and-hole type. After studying these solutions, it should not be difficult to solve the problem above

How to Solve the Popular Science Block Puzzle

IN VIEW of the unusual popularity which movable block puzzles are enjoying, a problem was offered our readers last month to move the blocks illustrated below from the position of a Greek cross



GREEK CROSS POSITION P.S. POSITION

First and last positions of the pieces with letters and numbers to aid in following the moves required for a solution

to a position resembling the letters PS (Popular Science).

For the purpose of demonstrating the solution, the blocks are lettered A to I. The box is numbered as if divided into 16 squares. Where two or more blocks are represented in the following tabulation by several letters together, all the blocks so represented are moved at once. The moves are:

CF to 8, 12, 16	F to 4, 8	A to 14
AB to 3, 4	DE to 10, 11, 12 14, 15, 16	F to 11, 15
D to 1, 2, 5		CG to 12, 16
E to 6, 9, 10	HA to 9, 13	DE to 2, 3, 4 6, 7, 8
I to 7	IB to 1, 5	
H to 15 and 11	C to 6 and 2	IB to 1, 5
G to 15	D to 6, 7, 10	HA to 9, 13
DE to 5, 6, 9, 10, 13, 14	E to 11, 14, 15	F to 10, 14
	F to 12, 16	G to 15
AB to 1, 2	G to 4 and 8	C to 16
GHI to 3, 7, 11	C to 4	E to 8, 11, 12
I to 4	DE to 2, 3, 6, 7, 10, 11	D to 3, 4, 7
GH to 3, 7		IB to 2, 6
E to 11, 14, 15	A to 15	HA to 1, 5
D to 9, 10, 13	H to 13 and 14	F to 9, 13
AB to 5, 6	IB to 9, 13	C to 14 and 10
HI to 1, 2	D to 1, 2, 5	C to 14
G to 3	E to 3, 6, 7	E to 12, 15, 16
C to 7	H to 10	

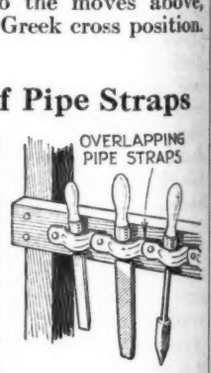
The blocks will now be in the PS position. When this solution has been mastered, try working the puzzle backward, without referring to the moves above, from the PS to the Greek cross position.

Ingenious Block Puzzles You Can Make Easily

THOSE who enjoy making and solving puzzles will find a number of the most fascinating problems with their solutions on our Blueprint No. 65 (see page 91). Included on the one sheet are a number of puzzles of the Chinese cross variety, a movable letter puzzle, the puzzles shown above, and one or two others.

Tool Rack of Pipe Straps

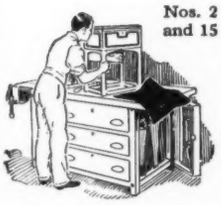
GALVANIZED pipe straps attached to a horizontal strip and nailed to uprights at the rear of the home mechanic's bench in the manner shown make an excellent rack for small tools. These straps are cheap and are made in several sizes.



Pipe straps make neat tool holders

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Blueprints for Your Home Workshop



Nos. 2 and 15

ANY ONE of the blueprints listed below can be obtained for 25 cents. The blueprints are complete in themselves, but if you wish the corresponding back issue of the magazine, in which the project was described in detail, it can be had for 25 cents additional so long as copies are available. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

POPULAR SCIENCE MONTHLY
250 Fourth Avenue, New York

GENTLEMEN:

Send me the blueprint, or blueprints, I have underlined below, for which I inclose.....dollars.....cents:

No.	Title	Described in Issues of		Price
1.	Sewing Table	Feb.,	'22	25c
2.	Smoking Cabinet	Mar.,	'22	25c
3.	End Table	Apr.,	'22	25c
5.	Kitchen Cabinet	May,	'22	25c
8.	Shaving Cabinet	June,	'22	25c
9.	Arbor, Gate and Seats	July,	'22	25c
10.	Porch Swing	Aug.,	'22	25c
11.	Bench and Tilt Table	Sept.,	'22	25c
12.	Electric Washer	Oct.,	'22	25c
13.	Tea Wagon	Nov.,	'22	25c
14.	Christmas Toys	Dec.,	'22	25c
15.	Workshop Bench	Jan.,	'23	25c
16.	Inlaid Radio Cabinet	Feb.,	'23	25c
17.	Cedar Chest	Mar.,	'23	25c
18.	Phone Table and Stool	Mar.,	'23	25c
19.	Grandfather's Clock	Apr.,	'23	25c
20.	Flat Top Desk	Apr.,	'23	25c
21.	Colonial Desk	Apr.,	'23	25c
22.	Cabinet and Desk	Apr.,	'23	25c
23.	Pergola Garage	May,	'23	25c
24.	Gateleg Table	June,	'23	25c
25.	Canoe Sailing Outfit	July,	'23	25c
26.	Baby's Crib and Pen	Sept.,	'23	25c
27.	Kitchen-Cabinet Table	Oct.,	'23	25c
28.	Pullman Play Table	Nov.,	'23	25c
29.	Toy Tea Cart, etc.	Dec.,	'23	25c
30.	Tool Cabinet, etc.	Jan.,	'24	25c
31.	Sewing Cabinets	Feb.,	'24	25c
32.	Chinese Game Table	Mar.,	'24	25c
33.	Dining Alcove	Apr.,	'24	25c
34.	Garden Trellises	May,	'24	25c
35.	Simple Radio Cabinet	Oct.,	'24	25c
36.	Rush-Bottom Chair	Nov.,	'24	25c
37.	Simplified Bookcase	Dec.,	'24	25c
38.	Sheraton Table	Jan.,	'25	25c
39.	Salem Chest	Feb.,	'25	25c
40.	Desk in Sheraton Style	Mar.,	'25	25c
41.	One-Tube Radio Set	May,	'25	25c
42.	Three-Stage Amplifier	June,	'25	25c
43.	Four-Tube Receiver	July,	'25	25c
44.	Pirate Ship Model—Hull	Feb.,	'26	25c
45.	Pirate Ship—Details	Mar.,	'26	25c
46.	Galleon Model—Hull	May,	'26	25c
47.	Galleon Model—Details	June,	'26	25c
48.	Sailing Yacht Model	July,	'26	25c
49.	Broom Cabinet	Aug.,	'26	25c
50.	Airplane Model (Flying)	Sept.,	'26	25c
51.	Clipper Ship Model—Hull	Oct.,	'26	25c
52.	Clipper Model—Details	Oct.,	'26	25c
53.	Clipper Model—Rigging	Nov.,	'26	25c
54.	Five-Tube Radio Set	Oct.,	'26	25c
55.	Five-Tube Set—Details	Oct.,	'26	25c
56.	Bird and Animal Toys	Dec.,	'26	25c
57.	*Constitution* Model—Hull	Jan.,	'27	25c
58.	*Constitution*—Rigging	Feb.,	'27	25c
59.	*Constitution*—Rigging	Mar.,	'27	25c
60.	Welsh Dresser	Mar.,	'27	25c
61.	Viking Ship Model—Hull	Apr.,	'27	25c
62.	Viking Ship—Details	Apr.,	'27	25c
63.	Toy Motor Boat—Hull	May,	'27	25c
64.	Toy Motor Boat—Details	May,	'27	25c
65.	Six Simple Block Puzzles	June,	'27	25c

Name.....
(Please print name and address very clearly)

Street.....

City and State.....

1 in

Can You Divide An Inch Into 1000 Parts?

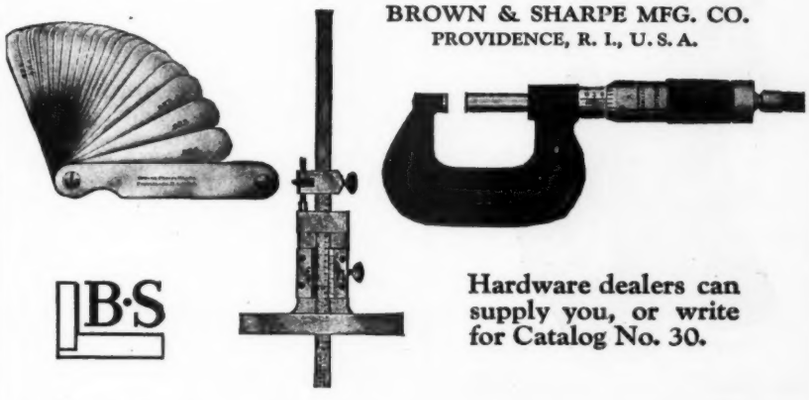
Mechanics do every day!

Making measurements accurate to thousandths of an inch is everyday work for Brown & Sharpe tools in the hands of mechanics.

In fitting small parts in automobiles, sewing machines, motors and in the manufacture of thousands of other products where accuracy is vital, Brown & Sharpe tools play an essential part.

Wherever mechanics must rely on accurate tools, they use Brown & Sharpe products with confidence that the work will be right. For the performance of Brown & Sharpe tools sets a standard of accuracy throughout the mechanical world.

BROWN & SHARPE MFG. CO.
PROVIDENCE, R. I., U. S. A.



B·S

Hardware dealers can supply you, or write for Catalog No. 30.

BROWN & SHARPE TOOLS

"World's Standard of Accuracy"

Keeps Your Eye on the Ball

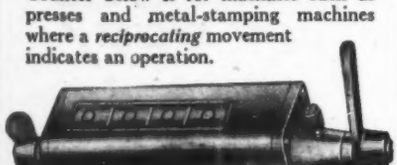
Your next "play" in developing a machine aims at the goal of higher *production*—and you'd like to see how it scores.

Your every move will *register* on a Counter; each change in mechanism or operating method. Just keep your eye on the dial!

You can gauge your gains in machine production and follow through to new *records* on your

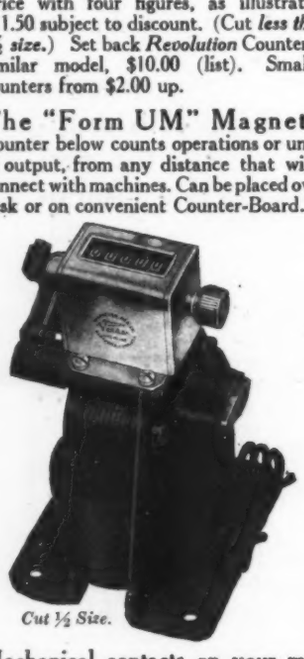
Veeder

The Set-Back Rotary Ratchet Counter below is for machines such as presses and metal-stamping machines where a *reciprocating* movement indicates an operation.



Registers one for each throw of the lever and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, $11.50 subject to discount. (Cut *less than ½ size.*) Set back *Revolution* Counter of similar model, $10.00 (list). Smaller counters from $2.00 up.

The "Form UM" Magnetic Counter below counts operations or units of output, from any distance that wires connect with machines. Can be placed over desk or on convenient Counter-Board.



Cut ½ Size.

Mechanical contacts on your machine make and break the electrical circuit which operates the counter. The electro-magnetic drive can get its current from your regular lighting circuit (110 volts), or from storage battery.

Write us about that counting problem of yours—at least ask for counter catalogue.

The Veeder Mfg. Co.
44 Sargeant St., Hartford, Conn.

A Driveway *for* Your Garage

(*Continued from page 75*)

mix will fill 38 lineal ft. of runway 18 in. wide and 6 in. deep. Have it dumped in several shallow boxes on the ground between the runways. Order only a cubic yard at a time, as it takes three or four hours to lay and finish.

The next easiest way, if the runways are, say, 50 ft. or more in length, is to rent the smallest machine mixer available, of about ¼-yd. capacity. This is especially desirable if the garage floor or other concrete work is to be done. Have all forms and equipment ready; then one or two days' use of the mixer will probably complete the work at low cost. Instructions for starting and operating the mixer can be obtained from the renting company. The machines are simple and easily operated.

IF YOU decide to mix by hand, first construct close to the forms a platform about 8 ft. square, of shiplap or tongue-and-groove boards laid on two by fours spaced about 2 ft. apart. Build in one piece so that the platform can be picked up and moved as the runways are filled with successive batches.

Use a square-pointed shovel, designed for this work. A long handle is usually preferred because it saves some stooping. A garden spade is handy for working the concrete against the forms. When one person is working unaided, a "batch" based as previously explained on one bag of cement will be found about the right size. Dump 2 cu. ft. of sand on the mixing platform, measuring it and the gravel in a bottomless box holding an exact cubic foot, 12 in. on every side.

Spread out the sand and distribute the bag of cement over it fairly evenly. Mix thoroughly by turning over until the entire pile has been moved four times or more. Now add water evenly, by using a hose or sprinkling can, and again turn the pile at least four times. Spread the "mortar" out, and add 4 cu. ft. of gravel on top, and again turn, in this instance at least eight times. Add water until the mushy mass when piled settles or flattens out under its own weight, but still does not run all over the board.

SHOVEL the mix into the forms, taking care to work it down into the corners as you go and force it against the sides of the form. Heap it about ½ in. above the top edge of the form, and shovel the entire batch into the form before smoothing the surface.

Now take a wood "float," which is simply a piece of wood 4 in. wide and about 14 in. long, with corners rounded and a handle in the middle, and carefully trowel the surface until it is smooth and just even with the top edges of the form. All gravel should be worked beneath the surface.

If a rounded corner is desired, use an "edging" tool, and for spacing into sections, as is usual on sidewalks, a groover is necessary. I have a very fair runway, however, without either of these special tools.

Leave the end of this section sloping, and immediately mix and place another batch. When you cease work at the end of the day, place a short board at the end of the work. When starting another section the next day, remove the board and place a strip of expansion material (asphalted felt). A still better way is to place the expansion strip first, tacked to the board, and then remove only the board when the next section is poured.

Freshly laid concrete should be covered. Leave it for a few hours until the surface is hardened and then lay boards across the forms. After a couple of days, place sand, earth, sawdust, burlap, or similar material on it, and keep this damp for a week by sprinkling. Always protect the concrete from the direct sun. If the work is done in rainy weather, the board cover will be sufficient, but a hard rainstorm within a few hours of laying will cause a pitted surface, even if the water merely drips through the cracks.

IF POSSIBLE, do not use the runways for three weeks or more. When removing the forms, be very careful not to chip or break the edges. As a rule it is best to leave the forms for several months, thus preventing too rapid drying of the edges and likewise protecting them from damage until they are hard.

Smoothing the surface as laid, by means of a wooden float, will give a semi-rough finish which is quite suitable for runways. Use of a metal trowel will give a smoother finish, but it may be slippery. If the grade is steep, or the slope is across the runways, it may be desirable to leave an extra rough surface by laying the wooden trowel on the wet surface just before the "initial set" and slowly raising it again. On very steep runways a series of "cleats" can be made by pressing a narrow strip of wood across and into the concrete just before the final set occurs, a few hours after it has been poured.

Any desired sort of design can be pressed into the surface, by making the "die" beforehand. With a small steel trowel or groover and some green paste, made by mixing mineral coloring matter with cement and water, decorative patterns can be laid out. A flagstone effect is obtained by making wide and irregular zigzag grooves in the surface and filling them with green mortar to simulate grass. From three to ten pounds of coloring matter per bag of cement is usually used.

It is also possible to color concrete by mixing in green or other mineral powder from the paint store. In order to save expense and avoid any possible weakening of the main body of concrete, it is advisable to mix thoroughly a mortar of cement and powder, adding gravel, and finally water. Use this as a top surface about ½ in. thick, applying it within about an hour—before the underbody has become hard.

Granite effects can be obtained inexpensively by mixing into the mortar granite and fancy crushed quartz chips, or marble dust. The top surface can be wire-brushed so as to bring out the attractive quartz surface.

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Roman Candle Propels Fireworks Barge

This toy boat, alight with fireworks, is a novelty for any Fourth of July celebration

WITH a few Roman candles, sparklers, flower pots, and the like, any boy can have a "whiz of a display" with a fireworks barge made as illustrated.

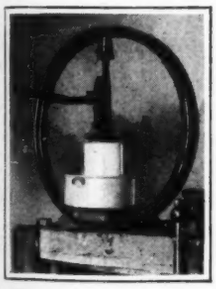
Cut a piece of board boat shaped, mount a cigar box on it, and set up two masts with the lids of baking powder tins nailed on their upper ends. Fix a holder for a Roman candle at the stern. With an awl or wire nail, make holes around the edges to receive sparklers.

Set the fireworks in place, clamp the Roman candle down firmly in its cradle with a block of wood, launch the boat and light everything, the Roman candle last of all, as its explosions will propel the boat through the water. If the pool is small, fit a rudder to steer the illuminated ship in a circle.—HI SIBLEY.

High Power Fruit Press Made with Auto Jack and Rim

IN THE illustration below is shown how I combined an auto jack and an old clincher rim to build a high pressure fruit press on my home workbench.

A hole was bored through a piece of 2-in. plank to receive a bolt, which was passed through the tire valve hole in the rim and through a hole in the bench. A nut drew the whole structure firmly in place.

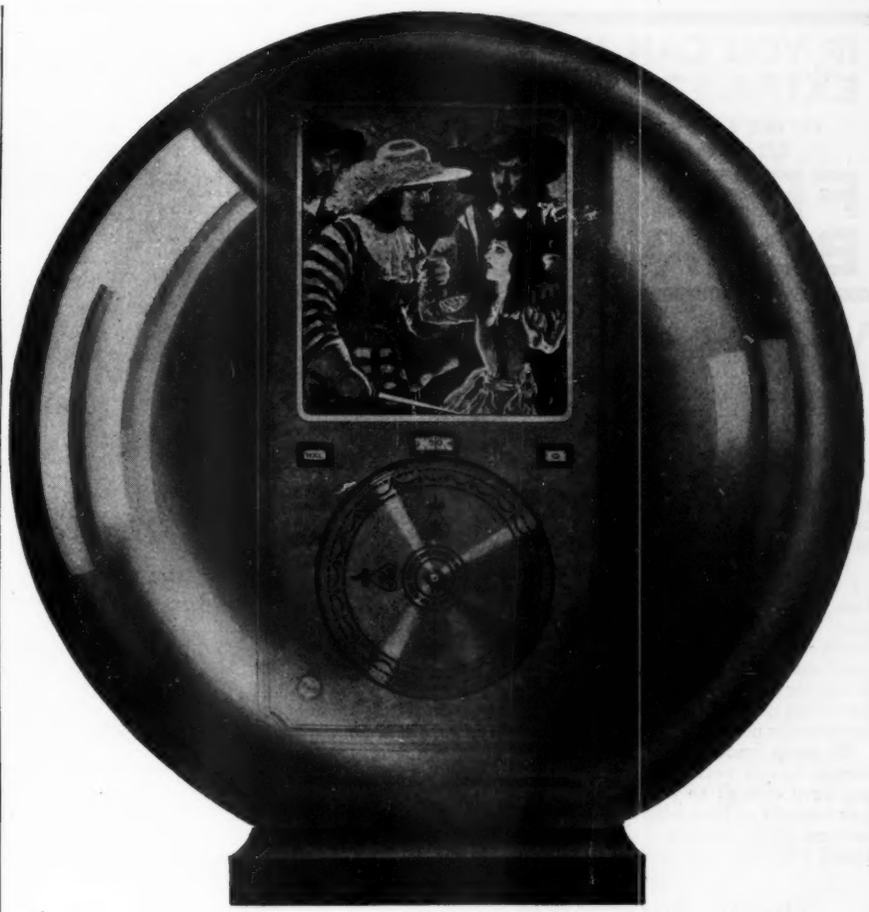


A powerful press for extracting fruit juices

A flat bottomed pan was placed on the plank, and inside of it, a vessel of smaller diameter with holes punched in its sides near the base to allow the juice to flow out freely into the larger pan.

A circular block of wood was fitted snugly into the inner vessel; on it was placed another block, on which in turn was set the foot of the jack. With the jack bearing against the top of the rim, the apparatus was complete and ready for operation.

If small quantities of fruit are to be prepared, it is sufficient to press the juice out into the lower pan, which is emptied when full. On a larger scale, it is better to punch a hole in the bottom of the outer pan so that the juice can be caught in another vessel. This, of course, ruins the pan for other purposes.—OWEN LOVEJOY.



TELEVISION—

With television now an accomplished fact, it may not be long before we are all taking our ease in front of a new type of radio, watching pictures spring out of the air.

Meanwhile, keep the electrical contacts of your present radio clean with a NICHOLSON Tungsten Point File.

Or, if you want to sharpen edged tools, use a NICHOLSON Mill Bastard File—or, again, if you need a tool to cut away metal stock, use the NICHOLSON Flat Bastard File.

There are NICHOLSON Files to meet every filing need today—and there will be in the future. You will be interested in our booklet "Adventures and Uses of NICHOLSON Files." Sent complimentary, of course.

NICHOLSON FILE CO.
PROVIDENCE, R. I., U. S. A.

NICHOLSON U.S.A. TRADE MARK

—A File for Every Purpose

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

IF YOU CAN USE AN EXTRA $20.00 BILL

write for this

FREE BOOK

YOU can save $20.00 in no time by using

SMOOTH-ON No. 1

to do your own household repairing—and in addition you will have that proud "I-did-it-myself" feeling.

Here is what one enthusiast did with two 35 cent cans:—A $25 lamp stand loose in base, two big leaks in heating furnace smoke pipe, loose hammer handle, and three loose hooks in tiled bath room wall were all put into good usable condition at an average cost of 10 cts. for each repair—and $20.00 easily saved over what would have been paid to professional fixers or for new parts.

By using Smooth-On to make dozens of the simple repairs necessary in every home, you can save enough to pay your radio upkeep, buy yourself or your wife a camera, a bull pup or some other pleasure giving article that you would otherwise hate to spend the money for.

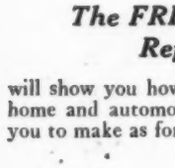
On the Automobile

Smooth-On No. 1, being unaffected by water, oil, gasoline or heat, is also excellent for automobile repairs. Try it for stopping radiator, tank, pipe line and hose connection leaks from the outside, keeping exhaust line connections tight to prevent the escape of obnoxious burnt gases, repairing cracked water jackets and crank, gear and differential cases, keeping grease cups, lubricator connections, nuts and hub caps from loosening and falling off, tightening loose hinges, robe rails, etc.

The FREE Smooth-On Repair Book

will show you how an astonishing number of home and automobile repairs are as easy for you to make as for somebody else.

Mail the coupon for a free copy and get Smooth-On No. 1 in 7-oz. or 1 or 5-lb. can from any hardware store.



Smooth-On Mfg. Co.
Dept. 58, 574 Communipaw Ave.
JERSEY CITY, N. J.

Do it with SMOOTH-ON

SMOOTH-ON MFG. CO., Dept. 58,
574 Communipaw Ave., Jersey City, N. J.
Please send the free Smooth-On Repair Book.

Name.....

Address.....

7-27.....

Return this coupon for a FREE copy of Booklet

There Is Still Time for You to Build

Our Viking Ship Model

By Capt. E. Armitage McCann

The completed model is a picturesque and colorful decoration, yet easy to make with the aid of our Blueprints Nos. 61 and 62. See list on page 91

EVEN if you are not one of those who have been building our Viking ship model from the instructions given in the April, May and June issues, you can begin now simply by sending for Popular Science Monthly Blueprints Nos. 61 and 62 (see page 91). These show all the parts full size and are undoubtedly the simplest of all our ship model blueprints to follow.

Those who wish may improve the appearance of the hull by doing some additional carving. Down the stem and stern on both sides of the centerpiece, from the head and tail, cut a pattern such as is indicated on Blueprint No. 62—scrolls or concentric circles.

On the ends of the gunwales there should be similar scrollwork patterns. Along the rest of the gunwales, I suggest cutting or burning a rune. One is given full size on Blueprint No. 61. On the steering gear, when it is made, you may burn the name of the Norse God "Thor" and on the oar blades, if oars are made, Ægir, the sea-god.

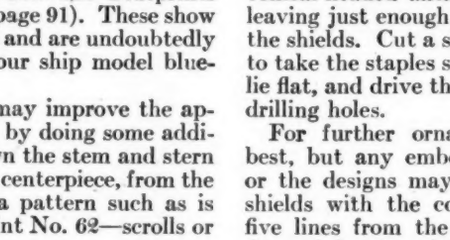
Next come the shields, of which there should be seventeen on a side. Button molds may be used, but they are clumsy. White and black checker men sawn in half would make good shields, but I found it just as easy to cut them from semihard-wood.

Plane down to ⅛ in. a number of strips that are more than 1 in. wide, and lightly nail four or five together. Draw 1-in. circles on these and fret-saw them. For about half their diameter shave them down to rather less than half their thickness. Make thin brass wire staples ¼ in. each way, and drive these into the backs.

Cut the points off 16 square and 18 conical-headed antique upholstery nails, leaving just enough shank to go through the shields. Cut a slot in a piece of wood to take the staples so that the shields will lie flat, and drive the fancy nails in, after drilling holes.

For further ornamentation, gesso is best, but any embossing paint will do, or the designs may be carved. On the shields with the conical nailheads, run five lines from the center to the edge. Around the edge of the other shields, place a series of dots. The backs may be varnished; the faces of the eighteen painted black with gold lines, and of the sixteen, yellow with black dots.

To put these in position, bore holes down through the gunwale and molding, each hole being in a middle position between the oar holes. Into each of these carefully drive with a touch of glue half of a round toothpick. When all are in, snip them off so that they project about ⅜ in. and give them a coat of light stain. The shields are dropped on these by their arm-holds (staples), but it is better to leave them off for the present.



The shields are cut from thin wood and decorated with upholstery nails and paint

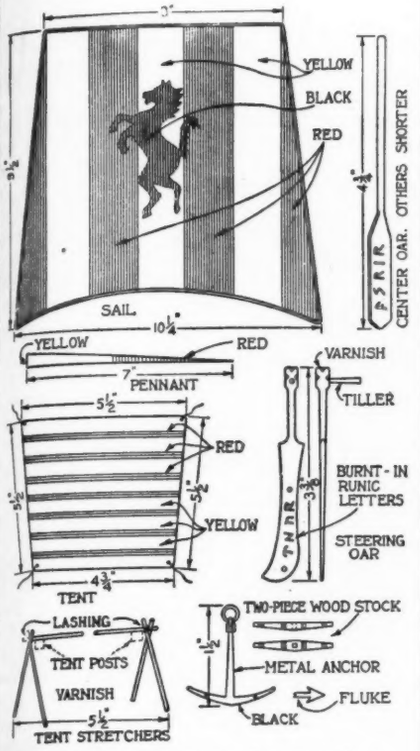
The steering oar is made of any wood 3½ in. long by ½ in. at the widest. When the bottom of the oar is level with the keel, bore a hole to take a pin driven into the hole in the lower cleat,

(Continued on page 85)

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Our Viking Ship Model

(Continued from page 94)



The sail, tent, pennant, steering oar, anchor, framework for tent, and center rowing oar

which was described last month. This should be an easy fit so that the oar will turn on it. Bore holes in the top cleat on either side of the oar and through them pass a cord to hold the oar, knotting the ends inboard. To a hole in the lower part of the blade, tie a cord; fasten the other end loosely to a hole in the backboard.

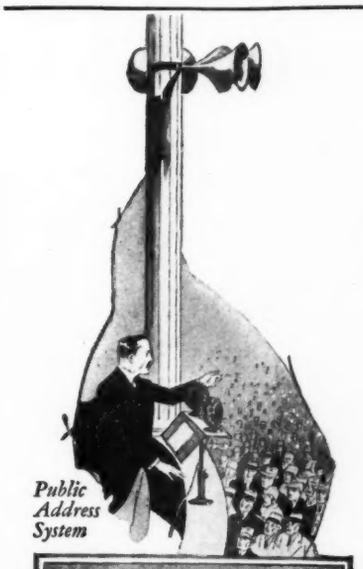
Poles will be needed for the tent awning. This may extend from the forward crotch to the after one, but it looks better to spread only the after end from the center crotch to the third one. One pole will lie in the crotches, extending about ⅛ in. beyond them. With thin cord lash it in position. Make four shorter poles to rest on the top of the hull proper and cross each other over the ridge pole, and lash them in position. All the poles are about ⅛ in. in diameter.

The tent itself may be linen or silk, striped yellow and red, red and white, or yellow and black. Tie the corners to the poles, or, more correctly, to holes in the gunwales.

The mast, which was previously made, should have a hole drilled 1⅛ in. from the top for the halyard.

The yard will be 8¾ in. long and 3/16 in. in diameter at the middle, tapering to about one third less at the end. Both spars should be stained brown.

The real sails were made of dyed wool, but this is rather heavy for a model, so silk or linen may be used. The example shown was made from a piece of silk shirting, with red, yellow and white stripes, so cut that the stripes are even on both sides. A plain silk or linen can be used and the stripes painted on it. The chief thing to remember is that we are building a ship (Continued on page 96)


Public Address System

Audiometer

Audiphone

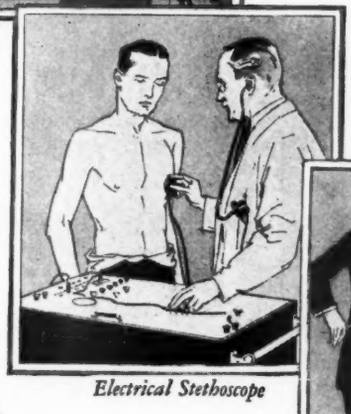
By-products of your telephone

THE microphone, familiar to the radio world, has been called "younger brother of the telephone." It is but one of a family of products which owe their existence to the communication system engineers and to the men who made your telephone at Western Electric.

Forty-five years' experience as manufacturers for the Bell System has brought not only a telephone that is the world's standard, but also a Vitaphone to give a voice to the motion picture screen; an Audiometer to test the hearing with accuracy never before possible; an Audiphone which gives new aid to the hard of hearing; an Electrical Stethoscope to amplify the faintest heart sounds; a Public Address System to carry a speaker's voice to crowds of thousands and tens of thousands.

Making telephones that are the world's standard, Western Electric has now broadened its field of activity to include the manufacture of many other types of equipment to communicate sound, and in so doing has immeasurably broadened its opportunity to serve.

Vitaphone


Electrical Stethoscope

Radio Telephone

Western Electric

Since 1882 Manufacturers for the Bell System

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

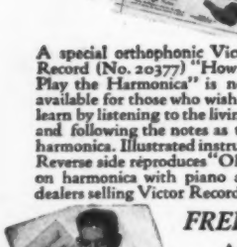
Get Ready to Join a Harmonica Band!

YES, you can learn to play as well as the next fellow. All you need is a Hohner Harmonica, our free instruction book, and a little practice — and first thing you know, you'll be reeling off the tunes like a veteran!

Pretty soon you'll be looking round for some other chaps to join you in a harmonica band—and that's when you'll really appreciate what fun there is in being able to play this "miniature orchestra."

There are harmonica contests, too, in which thousands of boys take part—and some mighty handsome prizes waiting for those who win!

A special orthophonic Victor Record (No. 20377) "How to Play the Harmonica" is now available for those who wish to learn by listening to the living voice of the instructor, and following the notes as they are sounded on his harmonica. Illustrated instruction sheet also included. Reverse side reproduces "Old Black Joe" as rendered on harmonica with piano accompaniment. At all dealers selling Victor Records . . . complete 75c



FREE Instruction Book

Anyone can learn to play the harmonica by following the clear, simple, illustrated instructions given in our booklet "How to Play the Harmonica." Free at your dealer's—or write to

M. HOHNER, Inc.
Dept. 504
114 East 16th Street
New York

HOHNER Harmonicas

Our Viking Ship Model

(*Continued from page 95*)

with a gold and black color scheme, helped out with a touch of red here and there.

On the center is painted a prancing black horse, having its mane tied with ribbons and a heraldic tail. The Norsemen seemed to have been particularly fond of horses by way of decoration.

The sail may have some thin shellac painted on where it is to be cut, to prevent fraying, or be hemmed, or have brown cord sewed around the edges. It may be allowed to hang slack, which I rather prefer, or may have wire sewn into the hems to make them belly out, or may be painted with thin gum arabic or shellac and bellied out with an electric fan while drying. The sail is shown hanging slack on page 94 and bellied out on page 70 of the April issue. You may take your choice.

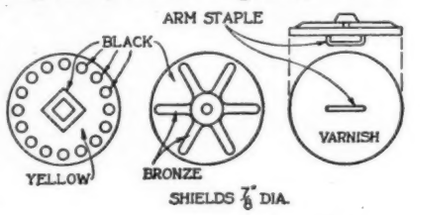
The top edge is sewed to the yard with a buttonhole stitch (marline-hitch). The lower corners have light cords sewn to them for sheets. To the center of the yard fasten a cord with a round turn and hitch, leaving a long end which is hitched round the mast; the other end goes through the hole in the mast, and is made fast to one of the beams.

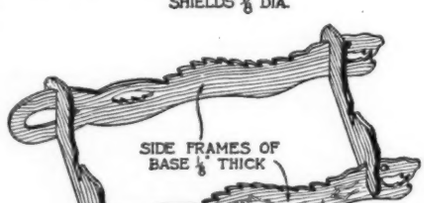
To the yardarms are fastened cords which are hitched to the after beam, and from near the top of the mast another cord leads to the stem, where it is tied under the dragon's head. From the very top of the mast there may be a long pennant flag of red or yellow.

The shields may now be placed on their tholes, alternate black and yellow, starting aft, so that they overlap slightly, the outer edges being the after ones. To prevent the shields from falling off, hitch a thin cord to the tholes.

There is no direct evidence as to the exact shape of the anchors carried by these vessels, because the iron part has rusted away, but from the wooden stock remaining, it would presumably be the shape illustrated on page 95. It may be cast or cut from sheet lead.

The cable is a piece of heavy cord about 10 in. long or two pieces laid together; this is hitched to the ring and twisted round the post on the bow, the rest being coiled down in the bottom of the ship.





How the shields are made and decorated, and a stand designed to carry out the dragon motif

This vessel has sixteen pairs of oars. These may be made and laid inside, or shipped by putting the ends through the oar holes. The center ones are 4½ in. long, the others gradually shortening to about 3½ in. long for the end ones. The flat blades are a full ¼ in. wide by 1⅝ in. long and the looms a full ⅛ in. in diameter. When shipped they are rather a nuisance and I think the ship looks as well without them.

There remains but a base, or stand, to make. This may be any pattern you please.

That is all! I am sure that those who have built the ship will have a very gay and interesting model in their homes.

May one also suggest, for those who like pairs, that it consorts very well with the pirate galley described some time ago in this magazine and for which blueprints (Nos. 44 and 45) are still obtainable.

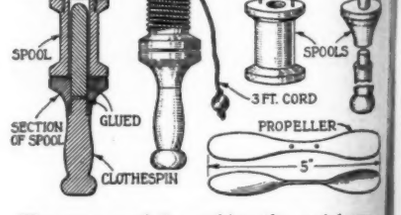
Next month, a ship model weather vane. Quaint decorations of this type are all the vogue.

Aerial Top Made with Spools and Clothespin

By F. Clarke Hughes

FOR this entertaining aerial top are needed two thread spools, a clothespin, a strip of tin or thin sheet metal, a short dowel, two small nails, and a 3-ft. length of heavy cord.

One spool is cut in half and into the small end of one of these sections is fitted and glued part of the clothespin, as shown. Into the large end is glued a short dowel. When the glue is dry, round the end of the dowel with sandpaper. This completes the handle.



The parts used for making the aerial top and how they are assembled for spinning

Cut out the sheet metal propeller, twist the ends, and punch two small holes about ½ in. apart, as indicated. Prepare the motor spool by driving two small headless brads into one end to receive the propeller. The toy then may be enameled in one or more colors.

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

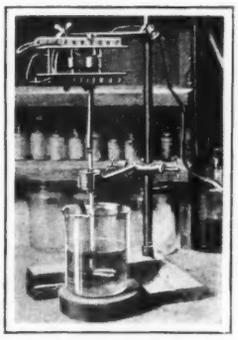
Home Workshop Chemistry

Simple Formulas that Will Save Time and Money

ACETONE is a light, mobile liquid, very volatile and inflammable. It is colorless, has a fragrant odor and mixes with water, alcohol and ether, as well as benzol. It can be obtained at the larger paint stores and chemical supply houses.

Primarily acetone is a solvent for camphor and celluloid. It is often used to clean bottles, flasks and cans, since it has a solvent action on many oils and rosins. At the same time, this liquid will remove any water present in such vessels, and, being volatile, it dries them quickly.

A bronzing solution may be made with the aid of acetone and cellulose acetate. Dissolve sufficient of the latter until a thin, flowing solution is obtained. Place the metal powder in this and stir it well. This will hold firmly on wood, metal or composition.



Mixing acetone and shellac with stirring device run by motor

If desired, celluloid chips may be used in place of the cellulose acetate. Celluloid from old photographic films is just as effective as purchased chips. In this case, however, benzol, acetone and amyl acetate must be mixed in equal proportions before the celluloid, which is cut into small pieces, can be dissolved.

Enough of the celluloid should be added to the solution to make a thick but easily brushed fluid. The metal powders, which can be obtained in any paint store and many hardware stores, are then stirred into the mixture. Only enough should be mixed for immediate use and it must be applied as quickly as possible.

A varnish, which is not especially strong or durable, may be made in an emergency. About 1 oz. shellac is dissolved cold in ½ pt. acetone with the aid of vigorous shaking. Pulverized rosin may be taken in place of shellac; it dissolves more rapidly. When a solution has been effected, ¼ oz. ozonized turpentine is added.

As a reminder, the following label may be pasted on the acetone bottle:

Acetone

(*Dimethyl ketone*) $CH_3 \cdot CO \cdot CH_3$

Keep this light, volatile liquid in a tightly corked bottle. Keep away from flames.

Dissolves celluloid. By smearing the cork and the neck of any bottle with this mixture, the bottle can be stoppered tightly.

A varnish can be made quickly in an emergency by dissolving shellac or even powdered rosin in this liquid.

Bottles, flasks and cans may be cleaned with acetone as it dissolves fats, rosins and oils. It is often used in paint and varnish removers.

Crowd *this* summer *with* real sport!

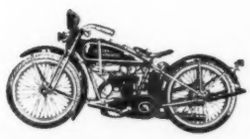
ALL outdoors is waiting for you. Slip away from the stifling heat and everyday scenes. A fishing trip for a day or a week! A jaunt over long stretches of country road! A spin through the fresh night air! Happy hours on the golf course — at the beach — or a couple of weeks of glorious, carefree vacation!

Enjoy yourself this summer as you never have before. Know the thrill that comes with the proud ownership of a Harley-Davidson Twin. This trim, good looking mount—sturdily built and dependable under any conditions — costs only 2¢ per mile for gas, oil, tires and all! Plenty of room in the sidecar for a friend and your outfit. Prices as low as $310 f. o. b. factory — on easy Pay-As-You-Ride terms.

See your Harley-Davidson dealer — send coupon for catalog.

HARLEY-DAVIDSON MOTOR COMPANY
Department PS Milwaukee, Wisconsin

HARLEY-DAVIDSON
Motorcycles

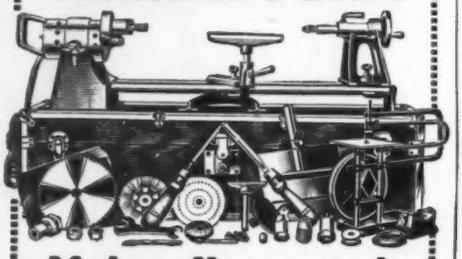


The Single is the famous Harley-Davidson solo mount — 80 miles per gallon. Price, $235 f. o. b. factory.

Mail the Coupon

HARLEY-DAVIDSON MOTOR CO.
Dept. PS, Milwaukee, Wis.
Interested in ☐ Twin; ☐ Single.
Send illustrated Catalog.
Name _____
Address _____

The New Red Jacket Craftsman's Lathe



Makes Homework Easy Now

It's fun to make furniture, garden trellis, toys, improvements and repairs with a set of tools like this carefully designed by a master workman.

The complete equipment consists of the powerful Red Jacket Motor, with **direct drive to an accurate wood turning lathe** (capacity 9 in. x 34 in.); **a bench saw**, that has depth and side gauges; **scroll and jig saw**; and **all accessories for both portable and stationary power drilling, buffing, grinding and cleaning.** Attaches to any light socket and converts your work bench into a complete private tool and machine shop.

only $10.00 down

A Special Crafts Course

And Blueprint Service is free to Red Jacket Shop owners—all that there is to know about handicraft methods, raw materials, woods, carving, sawing, turning, designing, carpentering, decorating, is taught by special correspondence.

Buy on Your Own Terms

Only $10.00 down. Liberal discounts for cash. Easy monthly payment plans. It is no hardship to own a Red Jacket.

Interesting Literature Free

Just send the coupon. You will be surprised with all it contains. Beautiful, instructive, Fascinating, Interesting. Everything Explained in Our Literature. Ⓢ

MAIL COUPON NOW

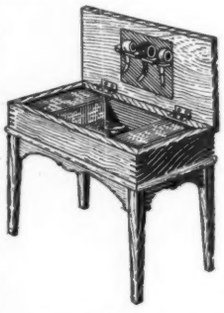
WACO TOOL WORKS,
2915 So. Wabash Avenue, Chicago, Illinois.
Manager, Dept. 7. Please send me particulars about 10-day free trial, free blueprints, and $10 down payment.

Name.....

Address.....

Low Smoking Stand Made Like Bench

By Charles A. King

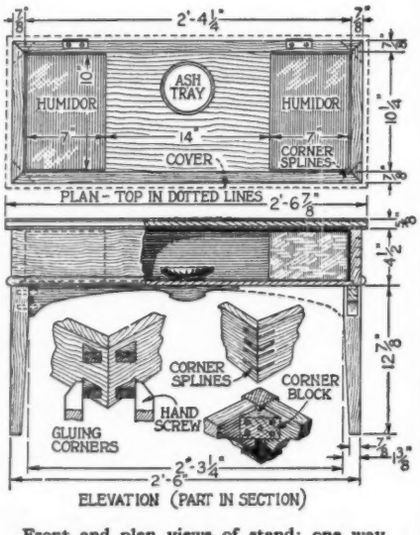


The stand serves as a seat when closed

IN THIS popular type of smoking stand there is ample space for a large assortment of accessories, all of which are hidden when the cover has been closed. The proportions of the piece are such that it may be used in an emergency as a seat and it is, therefore, especially serviceable in a small house.

Mahogany, oak or any semihardwood may be used. First make the rim of the box, rabbeting each piece to receive the ½ in. thick bottom. Miter the corners and glue on small triangular blocks as shown in the detail marked "gluing corners" so that hand screws may be applied to draw the joints together.

After the joints have been glued, the temporary blocks may be removed and saw cuts made through the corners as shown, so that thin splines may be glued in to reinforce the joints. The grain of the splines should run across the miter.



Front and plan views of stand; one way to make corner joints; reinforcing blocks

Simpler types of joints may be used, if preferred. Plain butt joints will do if the stand is to be made of a soft wood and enameled or lacquered.

Make the legs, shape the rails, and fasten them together with dowels. Then attach the case to the legs with brads or screws driven through the bottom.

Make the top, which is 12⅞ in. by 2 ft. 6⅞ in., of ⅝ in. thick plywood, if it can be obtained. Do not overlook the half-round molding, which is glued around the case at the bottom.

Zinc humidors or other fittings may be arranged and a piece of felt 9½ by 13 in. glued inside the cover as a background for a flexible wire pipe rack.

Do you want more sales through hardware stores?

WE HAVE distributors located in every important hardware jobbing center in the country now successfully selling our product.

This is a "ready-made" up-and-doing sales organization that is now available to manufacturers to sell to the hardware trade four or five additional products that have real merit.

Also we are in a position to assist manufacturer or patentee financially, if necessary. Please give full details in first letter, which will, of course, be treated confidentially.

This advertisement is inserted by an advertiser using Popular Science Monthly.

Address: Box W
Popular Science Monthly
250 Fourth Avenue, New York

BUY NOW ESTIMATES CATALOG FREE
A Complete Line — Big Variety
All New Stock—All Guaranteed
Established 1888

Save 40% PLUMBING HEATING WATER SYSTEMS

Send Sketch for Estimate

We quote the very lowest prices and give the highest class goods. Full information on all requirements. INSTALL YOUR OWN WORK. Tools loaned. Write us today for money-saving catalog. We supply everything.

B. KAROL & SONS CO. 800 S. KEDZIE AVE. Dept. 36 CHICAGO

FREE TO BOYS

"THE SHOOTER'S ART" Send Now!

Tells how to hold, aim and handle rifles; helps you guide others in correct knowledge of guns. Gives facts that make crack shots. Contains safety and common sense instruction every parent and boy should have. Helps to make boys leaders. Your copy Free. Write at once.

The Shooter's Art

The NEW BENJAMIN AIR RIFLE

Outshoots All Others

America's Original Air Rifle

$5 at your dealer's or sent postpaid. *Write!*

BENJAMIN Air Rifle & Mfg. Co., 629 N. Broadway, St. Louis, Mo.

MEN'S STRAP WATCH DIRECT FROM SWITZERLAND **$3.99**

Radium Dial · Jeweled Movement · Silvered, Curbed Shaped Case

This fully guaranteed watch cannot be manufactured in America for less than $12. Genuine leather strap. Accurate—durable—handsome. **SEND NO MONEY.** Pay on delivery $3.99 plus postage. "FEDERAL" U. S. Swiss Agents, 561 Broadway, New York City, Dept. P-11

Own a CORONA

The portable typewriter built like an office machine. Has four-row keyboard and big-machine features throughout.

Write to L C Smith and Corona Typewriters Inc 713 E. Washington St., Syracuse, N.Y.

Makes $150 IN A WEEK!
Opening Cans a Funny Way

Here's an amazing new way to make big money—easy as A-B-C! So surprising that R. A. Stewart cleaned up $151 in a week! All due to a startling little device that banishes old style can openers to the scrap heap.

MEN, this almost magical device is a real "million dollar" can opener. Imagine a little, inexpensive, automatic machine that opens any can, round, square, or oval at the turn of a crank! Cuts the entire top out slick and clean in a couple of seconds. No more snagging your fingers on jagged tin edges! No more fishing around with a spoon to get all the food out of a can! Speedo ends this bother and danger forever. No wonder women simply go "crazy" over this new wonder-worker! And no wonder that agents everywhere clean up $7 to $12 in an hour, steady as clockwork!

Agents! Distributors!

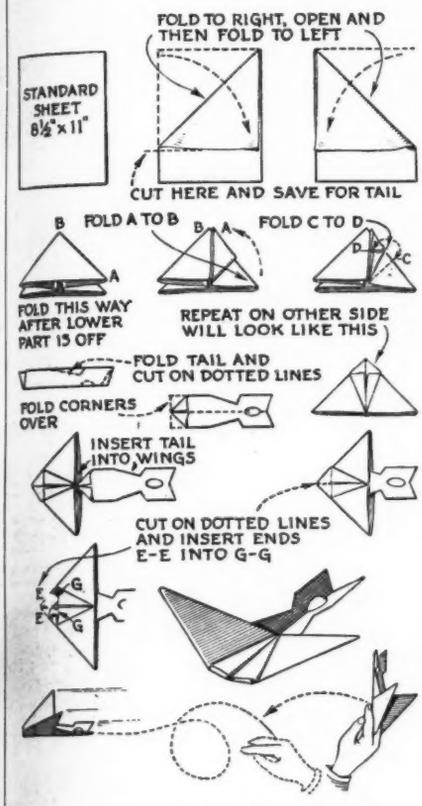
Write quick for exclusive territory and generous FREE TEST OFFER. Act today while the army is hot. Write to—

CENTRAL STATES MFG. CO.
4500 Mary Av. Dept. H-840
St. Louis, Mo.

Ⓢ This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Sturdy Toy Glider Folded from Letter Paper

FROM a piece of lightweight letter paper 8½ by 11 in., you can make a toy glider that will fly surprisingly well. It doesn't require any measuring or ruling and there is no pasting to be done. At the same time, the little plane is quite


FOLD TO RIGHT, OPEN AND THEN FOLD TO LEFT
STANDARD SHEET 8½"×11"
CUT HERE AND SAVE FOR TAIL
B FOLD A TO B A
FOLD C TO D D C
FOLD THIS WAY AFTER LOWER PART IS OFF
REPEAT ON OTHER SIDE WILL LOOK LIKE THIS
FOLD TAIL AND CUT ON DOTTED LINES
FOLD CORNERS OVER
INSERT TAIL INTO WINGS
CUT ON DOTTED LINES AND INSERT ENDS E-E INTO G-G

Steps in making the glider. Note how points E are tucked in to lock tail and wing

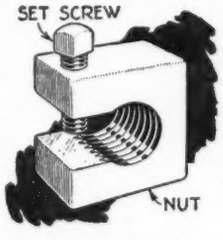
sturdy and, barring accident, will survive many flights.

The steps in making the glider are shown in the accompanying illustration, which is self-explanatory.

The most satisfactory way of launching the plane is to grasp it with the middle finger over the wing, as suggested in the sketch at the bottom of the illustration. Throw it forward, tail first, with a brisk downward motion. It will turn a loop and then fly gracefully and steadily in a straight line.—H. S.

C-Clamp Made from Large Nut

RECENTLY I needed a small but very strong C-clamp to aid in doing a repair job. Picking out a ¾ in. square nut and a suitable set screw from the junk box, I sawed out one side of the nut as shown and drilled and tapped it to take the set screw. This kink should be useful to model makers, who rarely have a sufficient supply of small clamps.—S. A. ASQUITH.



An easy way to make strong little clamps

To Men ···· who think their faces are clean

This cream goes into a clean-shaven face pink—and comes out a dingy grey

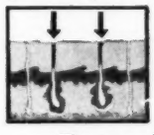
PORE-DIRT is in *every* face. It greys the cleanest complexion. It defies the daily wash, so that you think your face is clean when it isn't!

Where does it come from? Dusty roads, soot-belching chimneys, passing motors—the air teems with millions of minute particles of grime.

These particles are so small you can't see them. They are smaller than the skin pores; they get packed under the skin. There they hide, laughing at the wash cloth that cleans only skin surface.

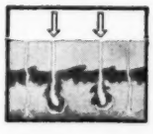
If pore-dirt is allowed to remain too long, a blackhead results. But generally it merely greys your skin, gives it a sallow look as though you had been up late the night before.

"Unwashable dirt," cosmeticians call it. But a minute's massage with Pompeian Massage Cream rolls every bit of it free.



Highly magnified cross-section of the skin showing how pore-dirt becomes imbedded in the pore. Surface washing cannot remove it.

The pore after Pompeian Massage Cream has cleansed it. The cream first loosens pore-dirt and then rolls the dirt out on the face.



Goes in PINK and rolls out a dingy GREY! Try it!!

Prove to yourself that Pompeian Massage Cream begins to clean where ordinary cleansing stops. First wash your face and hands as clean as you can.

Then scoop a little cream from the jar and massage it into your face. Keep on rubbing until the cream rolls out of your skin in tiny pellets.

Note this amazing thing—the cream that went into the skin a clean pink rolls out a dingy grey. The grimed-in dirt is now removed. Your pores can once more fully breathe. Your skin quickly responds to the invigorating massage.

Your face looks, feels, and *is* really clean!

FREE test convinces thousands. Test the benefits of Pompeian Massage Cream on your face—FREE. Fill in the coupon and mail it to us—right now while you are reading this magazine.

POMPEIAN MASSAGE CREAM

Pompeian Laboratories, Dept. 301 G
595 Fifth Avenue, New York City

Gentlemen:

Please send me a generous trial tube of Pompeian Massage Cream . . . enough for three facial massages.

*Name*_____

*Address*_____

*City*_____ *State*_____

Always strong at the finish

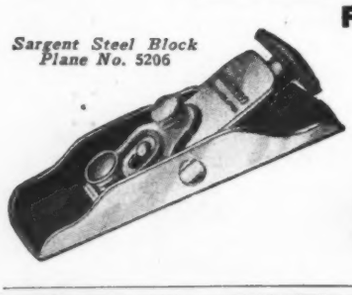
ON THE next to the top step of Bill Gettner's brand-new hand-made ladder lies the plane he should be using. It's the Sargent Steel Block Plane—the one for just such small jobs as rounding off the last sharp edges or for use in close quarters. But Bill simply couldn't resist showing how the big Sargent Auto-Set Bench Plane can be used for even such a close cut as this. It's a versatile plane—the Auto-Set—great for coarse or fine cutting and so much lighter than ordinary planes of the same size that you can use it for hours without tiring.

Both these Sargent Planes should be on every school and home work-bench. They are very moderate in cost and long-lasting. See them at your hardware dealer's and write us for descriptive booklet today.

SARGENT & COMPANY, *Manufacturers*, 50 Water St., New Haven, Conn.

SARGENT
PLANES

Sargent Steel Block Plane No. 5206



Sargent Auto-Set Bench Plane No. 714

Easy

A FEW weeks of pleasurable practice gives you command of the Conn saxophone which enables you to entertain yourself and friends. Be popular, increase your income if you wish! Start now with an *easy-playing* Conn. Choice of world's foremost artists—and costs no more. Free Trial, Easy Payments on any Conn. Write for Free Book, details. C. G. Conn, *Ltd.*, 732 Conn Bldg. Elkhart, Ind.

CONN BAND INSTRUMENTS

Only $5 Down buys a WITTE Engine

One Year To Pay—No Interest

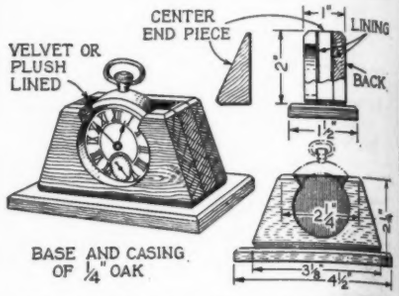
Lifetime Guarantee

50 New Features

Write today—for NEW Witte Engine Book telling how you can now buy a WITTE Engine for ONLY $5.00 down, balance small EASY Payments. No interest. Absolutely the greatest engine ever made. Used all over the world. Guaranteed for a lifetime. Runs on All fuels. Will increase your farm profits $500.00 to $1000.00 a year. Sizes from 1 1-2 to 30 h. p. Also 3-in-1 Saw Rigs and Pump Outfits. Write me today SURE for Free Book and EASY Terms Offer. Witte Engine Works, Dept. 222-B Witte Bldg., Kansas City, Mo. Empire Bldg., Pittsburg, Pa.

Neat Wooden Stand Holds Watch at Night

MY WATCH rests safely at night in a "watch slot" like that illustrated. The materials needed for making one like it are a thin strip of quartered oak or other hardwood, ¼ in. thick and 2 in.



How to make a case which protects a watch and allows it to be used as a small clock

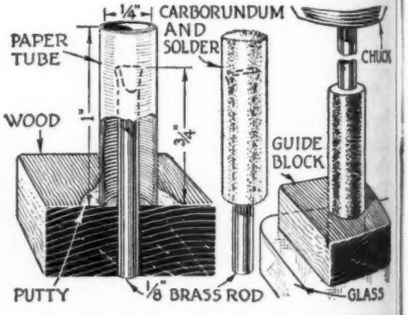
wide, and a scrap of felt. The parts are glued together, thoroughly sandpapered, and stained and varnished.

The interior then is lined with felt or velvet, and the bottom of the base is covered with some material to protect the table or bureau on which the stand is to rest.—F. D.

How to Grind Smooth Holes through Plate Glass

HAVING a number of ¼-in. holes to drill in a ¼ in. thick sheet of glass, I made the tool illustrated. It produced the holes easily without causing any chipping or breaking.

A 4-in. length of stiff brass rod ⅛ in. in diameter was flattened slightly at one end and was tinned with solder. A ⅛-in. hole was drilled vertically in a block of wood and the rod was inserted in it so as



Method of making a carborundum drill and using it to grind clean-cut holes in glass

to allow the flattened end to project ⅛ in. above the surface of the wood.

A long paper tube was made, having an internal diameter of ¼ in. The interior surface was shellacked to make it perfectly smooth. This was placed centrally over the projecting rod and held by means of putty. Molten half-and-half solder, in which coarse carborundum powder had been mixed, was poured into the tube around the rod.

To use the drill, a guide block having a ¼-in. hole was placed on the glass sheet and the tool held in the chuck of a hand drill.—W. J. EDMONDS, JR.

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

The Shipshape Home

"Curtains" for Garage

THE beauty of many otherwise well-kept yards is often marred by unsightly garage windows. Yet to attempt to keep the windows clean and covered with shades and curtains is an endless task.

My method of solving the problem is to dampen white scouring powder and apply it to the panes with a small rag or sponge.

The "curtains" which so greatly improve this garage are made with scouring powder

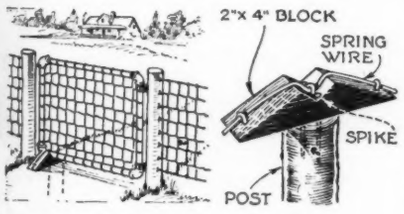
The rubbing can be done either straight up and down or so as to form a sort of floral design. Then the center of the lower panes is wiped out in the shape of an inverted V.

The rag and damp powder are next applied along the edges of this V with a circular motion to give the appearance of ruffles on the curtains. My own practice is to use pink colored chalk for the ruffles. —FRANCES AUSTIN TROUTMAN.

Convenient Gate Latch

THE simple latch illustrated will keep an ornamental wire gate closed, yet it requires no time or attention to operate as do many types of latches and hooks. Furthermore, it will last for years and never get out of order.

Set a block 2 by 4 by 12 in. on edge and in the center cut a V-shaped notch 1½ or 2 in. deep and 2 in. long. From each point



This latch for a light, ornamental iron gate is easy to make and foolproof in operation

of the notch, bevel off to the end of the block. Bend a piece of heavy brass wire to the shape of the block and staple it in place so that it will act as a spring. Exactly under where you wish the gate to stop when closed, drive a good cedar or locust stake and spike the block to it.

From the fact that the gate is held shut only from the bottom, the catch could not be recommended for use on gates where horses or cattle are kept, but for poultry yards or gardens it is efficient and will save much annoyance and time. —CHARLES E. GARDNER.

The *Vulcanized* Repair

When you fix a puncture with the Shaler 5-Minute Vulcanizer the patch is there to stay for the life of the tire. Even under the constant flexing of Balloon tires which loosens ordinary cemented patches, Shaler improved Patches are not effected. For this reason *alone* you should be sure that every puncture is Shaler Vulcanized—to prevent the trouble and tire expense that results from under-inflation due to leaky repairs. But there's another reason.

The Shaler 5-Minute Vulcanizer takes the work and muss out of puncture repairing. It is so *simple* and *safe* a child can use it.

To make a repair you simply clamp one of the Shaler Patch-&-Heat Units over the puncture, touch a match to the fuel, give it five minutes to cool; then unscrew the clamp and throw the little fuel pan away. That's all. No gasoline—no sticky cement—no muss. The repaired tube is as good as new and ready for immediate use.

Be sure you have a Shaler 5-Minute Vulcanizer in your car today. You'll find them in stock wherever auto accessories are carried. If you have a Shaler now, be sure you have a supply of the improved Shaler Patches especially designed for Balloon tires.

The SHALER Company

World's Headquarters for Tire Repair Equipment

1007 Fourth Street - Waupun, Wis., *Branch Factories:* Beeston, Eng., and Montreal, Can.

SHALER

REG. U.S. PAT. OFF.

5 MINUTE VULCANIZER

EASY TO USE

Be sure you have this handy outfit in your car today. Fixes punctures in a jiffy anywhere—and fixes them right. Complete outfit—$1.50. Extra Patch-&-Heat Units, 75c per box of 12. Prices slightly higher in Canada and far West.

There are just two kinds of homes today

those that have oil heat —and those that haven't

THERE was a time—not so long ago—when the automobile was the dividing line between those who "belonged" and those who didn't. Of course, no such distinction will ever be made regarding oil heat—but the fact remains that the most progressive people in every walk of life now regard automatic heat as a necessity.

Think what it means to turn over all your heating problems to a little thermostat that does all the worrying for you, looks after the furnace while you're enjoying those last precious moments of sleep; keeps your house always at the temperature you like best, with never more than 2° variation; does away with the drudgery of the coal shovel, with ashes, soot, dust and dirt; in short, takes every thought of the furnace off your mind and leaves you and all your family free to revel in luxurious comfort all winter long. That's NOKOL automatic oil heat.

Here is a burner that revises all previous conceptions of oil heat—a burner that not only eliminates the usual oil-burning *noise*, heretofore the main objection to oil heat, but attains a new standard of performance and efficiency. Its amazingly efficient method of combustion does away with soot, carbon and dirt, with smell of oil, with wasteful operation. It gives full automatic heat at unusually low cost; a cost about the same as hard coal—often less. Mail the coupon for free booklet on oil heat and details of our convenient budget plan.

NEW *Silent*

NO COAL NOKOL

REG. U.S. PAT. OFF.

AUTOMATIC OIL HEATING FOR HOMES

FREE—NEW BOOK

AMERICAN NOKOL COMPANY
4166 Schubert Ave., Chicago
Please send me your new book on OIL HEAT.

Name.....

Address.....

City..... *State*.....

The SHIPSHAPE HOME

You Can Do Better Painting If You Look After Your Brushes Carefully

By BEN BRIGHTON

MUCH of your success in keeping your home shipshape depends upon how well you can do painting, varnishing and lacquering. And this in turn depends to a surprising extent upon the brushes you use.

It takes a good brush to do a good job, yet many amateurs will use ten-cent brushes in spite of the fact that a professional painter with years of experience finds it necessary to use the best of tools.

Good brushes naturally cost more than poor ones, just as paint of good quality costs more than cheap paint. You may be surprised to find how much good brushes do cost as compared with the glorified whisk brooms that are so often sold at cut-rate paint counters. The cost of a good brush, however, is only a small percentage of the cost of the materials used in painting, and, furthermore, good brushes will last for years. A first-class brush is always true economy.

As an amateur cannot tell by inspection whether a brush is a good one or not, it is important to buy brushes made by a manufacturer of first-rate reputation or to rely upon the guarantee of a dependable dealer. It makes considerable difference, for instance, whether a brush is made of "flagged" or "butt" bristles; the former is by far the more satisfactory.

It is quite as important to select brushes adapted for the work you are doing. Varnishing and enameling require one type of brush, floor work another type. Wall painting calls for regular wall brushes. Outside painting is done with house painting brushes.

For varnish, enamel and the new brushing lacquers, brushes of the soft bristle type are best. Fitch, bear-hair and ox-hair are all used. Professional auto finishers and some others like camel's-hair, but it is better for the amateur to use one of the other types. A 2-in. or 3-in. flat brush, preferably the latter, are good sizes for average requirements. You also ought to have a 1-in. or 1½-in. brush for small surfaces, as well as a very small brush such as a pencil brush or a ¼-in. square-cornered brush of soft bristle.

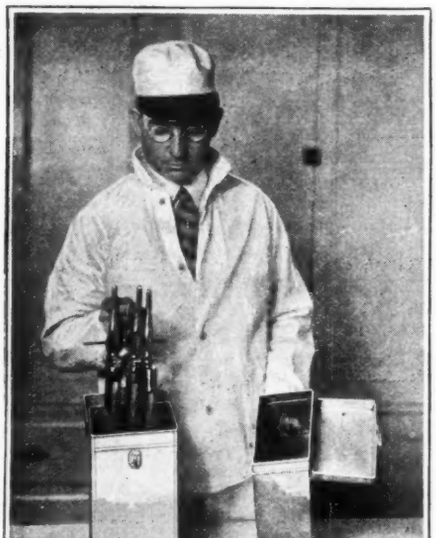
For walls and ceilings a flat wall brush should be used, preferably 4 in. wide.

For floors, you will have a choice between a 2½-in. round or oval brush or a 4-in. flat brush. While some painters prefer a flat brush, it is generally considered that the round type produces best results, especially in the hands of an amateur.

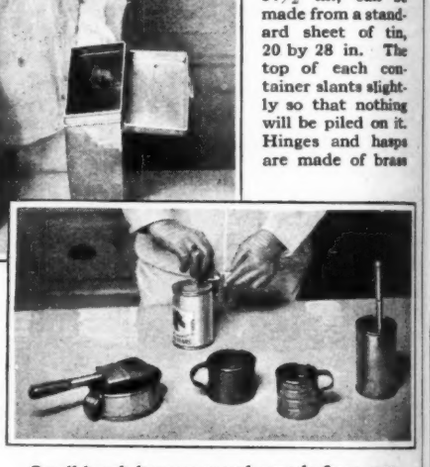
When doing outside painting, either a flat or a round brush may be used. The advantage of the round brush is that it carries more paint and compels one to brush the paint well into the surface, especially on siding. The sizes most extensively used are 2½ in. and 4 in. for round and flat brushes, respectively. A flat or oval sash tool, which is a small, long-handled brush, is needed for window sash and small trimming. A duster, preferably of the 4-in. flat type, is useful.

Bristles are set in rubber, glue or cement. Glue-set brushes never should be put in water. Cement-set brushes are not to be used in shellac or anything containing alcohol. Rubber-set brushes can be used in practically any material.

Even the best new brushes have a few loose bristles. They can be worked out with the fingers after wetting the brush with oil or tur- (*Continued on page 103*)



The type of permanent brush keeper used by Ralph G. Waring, noted authority on wood finishing, is shown at the left. A cross wire runs through the brush handles and rests in stirrups soldered inside the can, as can be seen in the empty container. The cans, which are 4½ by 6½ by 14½ in., can be made from a standard sheet of tin, 20 by 28 in. The top of each container slants slightly so that nothing will be piled on it. Hinges and hasps are made of brass



Small brush keepers may be made from carefully opened vegetable cans. The varnish pan at left was cut from the bottom of a one-gallon can. It has a removable wire rest for the brush

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Look After Your Brushes

(*Continued from page 102*)

pentine, or by dipping the brush in oil or paint and brushing it on a clean board. The brush can be very well cleaned, too, simply by striking the dry bristles across the extended fingers, as a boy runs a stick along a picket fence.

The best way to keep your brushes in good condition is to clean them thoroughly after each painting operation. Gasoline is the most economical cleanser, although turpentine, benzine and naphtha are all good.

For brushes used in enamel, varnish or paint mixtures, a good cleanser may be made by mixing two parts of gasoline and one part turpentine.

BRUSHES that have been used in shellac must be cleaned with wood or denatured alcohol, or if hardened, with varnish remover followed by alcohol. The cleaning process may be carried further by washing brushes with warm water and soap, but do not make the mistake of some amateurs who take all the life out of their brushes by using a cheap soap, strong in alkali.

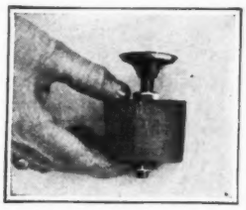
Hang the clean brush up by the handle until dry, then wrap it in paper folded flat so as to keep the bristles properly shaped and protect them from dust. Do not store brushes in a hot, dry place, as the block may shrink or the bristles become loose.

When brushes are used rarely, that is at intervals of a month or more, it is best to treat bristles with vaseline or paraffine oil, and wash them out with gasoline just before using. This keeps the bristles straight and full of life.

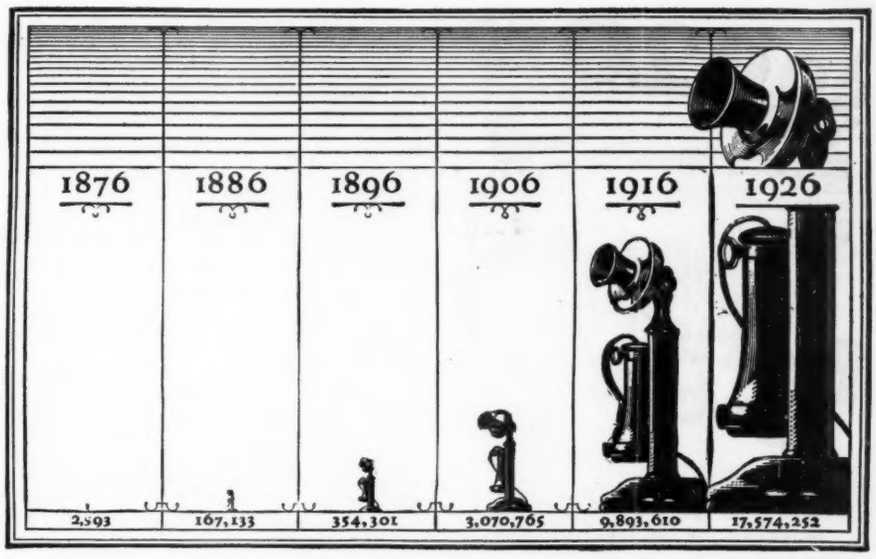
Some painters prefer to keep brushes in a receptacle of oil or some preparation such as one part oil and one part turpentine, which they term a "brush keeper." This is an excellent method if one remembers to renew the liquid as it evaporates. Provide a cover for the container. Either drive a tack into each brush handle and suspend it from the edge of the receptacle, or hang it from a wire or stick across the top. If the brushes are allowed to stand on the bottom of the container, the bristles are certain to curl.

Preserving Large Corks

THE cork used in a large bottle in which I keep linseed oil stuck and broke repeatedly until I devised the method illustrated for preserving large corks. I thread the stem of an old Ford valve, make two large sheet metal washers for the top and bottom of the cork, and tighten them in place with two 5/16-in. nuts. Incidentally, the head of the valve makes a fine stand for the cork when it is laid down temporarily on a bench or table, or on the ground.—FRANK W. BENTLEY, JR.



Large cork reinforced with Ford valve stem



Milestones in National Service

An Advertisement of the American Telephone and Telegraph Company

THERE are twenty-five Bell companies but only one Bell System—and one Bell aim and ideal, stated by President Walter S. Gifford as:

"A telephone service for this nation, so far as humanly possible free from imperfections, errors or delays, and enabling anyone anywhere at any time to pick up a telephone and talk to anyone else anywhere else in this country, clearly, quickly and at a reasonable cost."

The year 1926 brought the service of the Bell Telephone System measurably nearer that goal. Seven hundred and eighty-one thousand telephones were added to the System—bringing the total number interconnected in and with the Bell to more than seventeen and a half million.

The number of applications waiting for service, including those in new and outlying sections, was reduced fifty per cent.

A third transcontinental telephone line was completed to the Pacific coast.

The largest number of miles of toll wire for one year was added to the System—more than 664,000 miles.

The average length of time for completing toll calls throughout the System was lowered by thirty-five seconds.

A seven per cent improvement over the previous year was made in the quality of voice transmission in toll calls. An adjustment was made in long distance rates amounting to a reduction of about $3,000,000 annually.

PLUMBING-HEATING
Install Your Own~Save Half

Lowest wholesale prices on highest quality Grade A goods. Any Handy Man can install his own Plumbing and Heating BY OUR NEW EASY METHOD. Get the best and pay only a little each month.

Send for FREE Book.

New bargain catalog just issued. With our cut-to-fit systems you save waste material and high labor cost. 50 years of economical service to home owners, farmers, builders and mechanics. Million Dollar Plants back up our Bonded Guarantee. FREE book gives you the whole story. Write for your copy today.

OVER 50 YRS. **HARDIN-LAVIN CO.** EST. 1876
106-16 West Pershing Road, Chicago, Ill.

A Motor Boat -for half the cost!

The Super Elto clamps on any open boat—gives all motor boating pleasures at amazingly small cost. Powerful, speedy, reliable. Light and portable. Write today for intensely interesting catalog! ELTO OUTBOARD MOTOR CO., Ole Evinrude, President, Mason St., Dept. W, Milwaukee.

The Super Elto — Starts with a Pull

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

$2920.00

worth of hunting, fishing and camping equipment will be *awarded* as prizes for the biggest fish entered in the 1927

Big Fish Contest

Conducted by America's leading magazine for the Outdoorsman

Field & Stream

Conducted for the past 16 years, Field and Stream's annual PRIZE FISHING CONTEST is to the angler what the Kentucky Derby is to the horseman. Record fish listed every year in World Almanac. With prizes ranging from $100 to $10, covering 15 classes of game fish, the 1927 contest will be biggest of all. Yet many prizes will be won with fish of no extraordinary size. WINNERS SELECT THEIR PRIZES. Get into the contest yourself this year!

Send $1 for 5 months' trial

Complete details in the current issue. Get copy from newsstand or send $1 for 5 months' trial subscription to Desk P, 45 W. 45th Street, New York City.

Field & Stream has over 50,000 feet of the finest motion pictures of hunting and fishing ever made, obtainable on terms amounting to FREE LOAN. The best entertainment for banquets, smokers or other meetings of clubs and associations of every kind, or private entertainments. Write for full particulars.

Ask the Man Who Mows One

The tougher the beard, the easier it is to shave with Barbasol. . . No brush. No rub-in. No after-smart. Try Barbasol—3 times—according to directions.

"Mister, you're next!"

Barbasol

For Modern Shaving

The Barbasol Company
Indianapolis, Ind.

I enclose 10c. Please send trial tube.

Name.....

Address.....

P-S-M-7-27

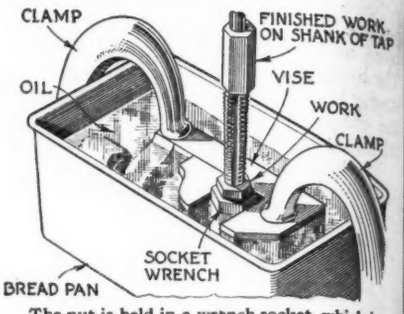
Small Shop Method for Tapping Nuts

A SIMPLE and effective rig for the quantity tapping of nuts is illustrated. It can be made up readily in the smallest shop from materials that are always at hand.

The only economical way of tapping hexagon or square parts is in a second operation, and the use of such a method becomes almost imperative if, as in the present case, the part is rather long, while at the same time a nearly full thread is required.

A regular wrench socket of the required shape and form, such as is used in a well-known type of socket wrench, is held between the jaws of a small square vise, which in turn is placed in an ordinary small bread pan and clamped to the table of the drill press. The pan is filled with cutting oil to the required depth. In the drawing the oil level is shown rather low to reveal the arrangement, but in practice the oil should nearly cover the product.

A regular long nut tap is used and held in the regular chuck of the drill press. The press should be so arranged that when the lever arm is in a vertical position, pointing down, the tap is at the end of its run. Whenever possible, a spindle depth stop should be used.



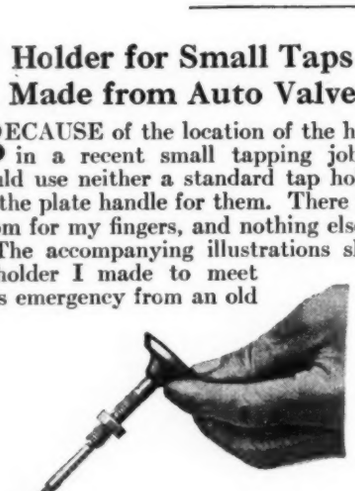
The nut is held in a wrench socket, which is clamped in a vise and submerged in oil

In operation, a nut or other product to be tapped is dropped into the socket, and the tap, with the weight of the lever arm on it, started. When the spindle gets to the end of its run, the nut starts to rise and continues to rise until it passes beyond the thread of the tap, when the spindle is raised and another part put in. It is necessary for the socket to be placed so high that the end of the threads on the tap, in the lowermost position of the latter, will be just slightly below the top of the socket; that is to insure the product's being pushed on to the plain shank in every case and thus to allow the next part to slip on.

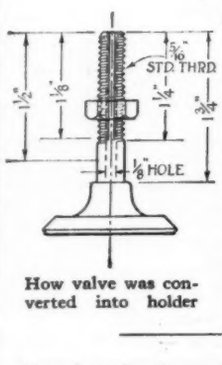
Holder for Small Taps Made from Auto Valve

BECAUSE of the location of the holes in a recent small tapping job, I could use neither a standard tap holder or the plate handle for them. There was room for my fingers, and nothing else.

The accompanying illustrations show a holder I made to meet this emergency from an old Ford engine valve.



An emergency tap holder for use in close corners

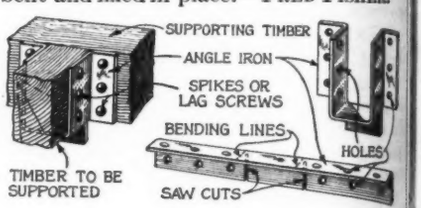


How valve was converted into holder

The tap, of course, is tightened by turning forward the 5/16-in. nut. For my lighter taps, it seems to please the hand a little better than several other expensive T-handle holders I have. It is a good kink to remember.

An Angle-Iron Timber Hanger

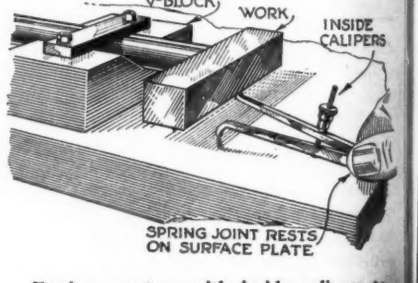
A TIMBER hanger can be made cheaply and easily from a piece of standard angle iron. Two cuts are made in the leg of the angle at a distance apart equal to the width of the timber to be held, and holes are drilled for the spikes or lag screws. Then the angle iron is bent and fixed in place.—FRED FISHER.



How a length of angle iron is cut, drilled and bent to form a hanger for heavy timber

Inside Calipers Serve as Surface Gage Substitute

WHERE a surface is to be set up on the milling machine or planer parallel to the table, a pair of inside calipers will serve in place of a surface gage. The caliper spring is held on the table and the fingers are placed so as to prevent the upper point from tipping sidewise. The lower point, is kept in contact with the table.—J. F. HARDECKER.



Testing a set-up with inside calipers to make sure the work is parallel with table

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Old Bill says—

THE mechanic who is good at making excuses is seldom good at anything else.

About half of the resistance of a tap is caused by friction; indeed, this has a greater tendency to break the tap than has the actual cutting.

Don't tie your good ideas to a cloud; they may always remain nothing but mist.

Where extreme accuracy is required in the measurement of angles, a sine bar will give more satisfactory results than a bevel protractor.

The sine bar is not as difficult to use as many young mechanics imagine, yet it is capable of determining angles to fractions of a second.

You need never brag about your ability or what you can do; what you do will speak for itself.

If you have trouble with chatter marks when grinding, probably the wheel is out of balance; correct this or select another wheel.

As there is pride in ownership, there should also be pride in workmanship.

A diamond for truing grinding wheels should not be used too long without resetting and it should be inspected frequently for cracks or looseness.

Always set a diamond below center, never above; and flood it with water whenever possible.

Take light cuts with the diamond to avoid overheating and change its position frequently so that a large surface is never in contact with the wheel.

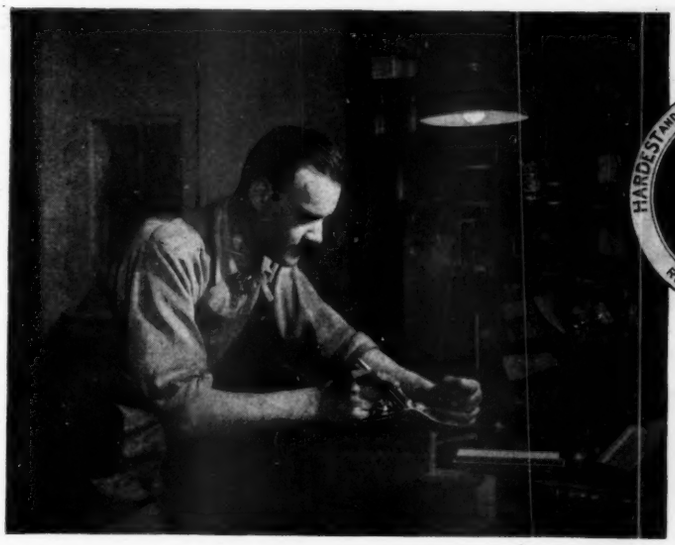
It is important to remember that heavy cuts and no water will soon wear a flat spot on the point of the diamond; this causes excessive heat and is apt to loosen the setting.

Guard for Tapeline Case Made from Old Inner Tube

LEATHER tapeline cases will stand some throwing about in the tool box, or dropping on the floor, but this is not so of the type with composition sides and a brass rim. The brass soon loosens from the sides and the case comes to pieces.

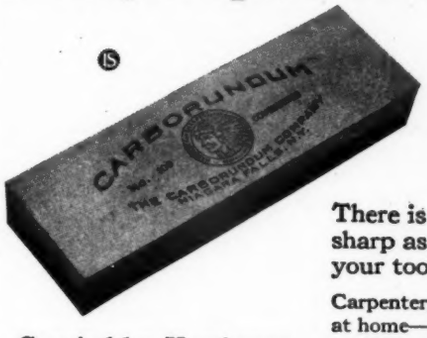
To protect this type of case from abuse, a section of inner tube about 1¾ in. long can be stretched over it as is shown. A hole is cut to permit the tape to unwind.—F. W. B.

Rubber binding protects edges of case



Carborundum is the Registered Trade Name used by The Carborundum Company for Silicon Carbide. This Trade Mark is the exclusive property of The Carborundum Company.

An edge tool is only as good as its edge
Always keep a CARBORUNDUM STONE *handy*



Carried by Hardware Dealers Everywhere

WE SUGGEST
No. 108—8 x 2 x 1 inches
No. 109—6 x 2 x 1 inches
No. 110—7 x 2 x 1 inches

Send for catalog P-1 for complete list of Carborundum Products

You can trust your finest edge tools to a Carborundum Combination Stone—the stone that always gives a better edge quicker.

Keeps every edge tool in perfect working shape.

There is no other material that is so hard and sharp as Carborundum and it *cuts* an edge on your tools amazingly fast.

Carpenters, craftsmen, the man who has a set of tools at home—all users of edge tools should complete their tool kits with a Carborundum Combination Stone.

It is made with one side coarse grit for taking out nicks and bringing the tool to an edge—the other side fine grit for giving the smooth finished edge. Every stone uniform in grit and grade. It will not wear unevenly—lasts a life time. Always has a free cutting action. Will not readily fill or glaze.

You can use this stone dry or you get a smoother edge by the use of oil.

Carborundum
REG. U. S. PAT. OFF.

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.
CANADIAN CARBORUNDUM CO., LTD., NIAGARA FALLS, ONT.
Sales Offices and Warehouses in New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Grand Rapids, Milwaukee
The Carborundum Co., Ltd., Manchester, Eng. Deutsche Carborundum Werke, Dusseldorf, Germany

Design, Workmanship, and finish of the high st order are found in all
Gerstner Tool Cases
for
Toolmakers and Machinists
They please. Write for free catalog.
H. GERSTNER & SONS
543 Columbia St., Dayton, O.

BUILD YOUR OWN GRANDFATHER'S CLOCK
We furnish blue prints and instructions. Buy the works and dial from us at surprisingly low prices. Make fine profit building artistic clocks for your friends. Plain Works as low as $5.00. Others with Chimes at all prices. Ask for attractive free offer.
AMERICAN CHIME CLOCK CO.
1601 RUFFNER STREET PHILADELPHIA

A 2c STAMP —will start you on the road to success. See Money Making Opportunities on pages 116 to 135.

It's Easy to Build Things!
—when your ripping, mitering, grooving, etc., are done on the
Boice-Crane Handisaw
Made in two sizes. Swings saws as large as 8" to cut 2½" stock. Attachments for grinding, dadoing, sanding. Driven by any ¼ to ½ h. p. motor. Attaches to light socket. Sold with or without motor.
Send 10c for descriptive catalog of bench saws, drills, jointers, band saws, and lathes.
W. B. & J. E. Boice
Dept. P.S.7-C
Toledo, Ohio

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

NO need now to let cracks or holes in walls and ceilings make a room look shabby. With Rutland Patching Plaster you can easily and quickly fix them like new.

You just mix this handy plaster with water and fill the crack or hole. The patch will be as lasting as the wall itself.

Rutland Patching Plaster will not crack, crumble or fall out. It will not shrink as plaster of paris shrinks. It's easier to use than plaster of paris because it does not get hard or "set" instantly.

Paint, wall-paper and hardware stores sell it. If your dealer hasn't Rutland, we will mail a package direct and you can pay the postman 30c. plus postage. Rutland Fire Clay Co., Dept. R-10, Rutland, Vermont.

Rutland
Patching Plaster

MAKE
BIG SPARE-TIME
MONEY

Have fun playing for dances, and get good pay for it. You can be ready in sixty days with a

BUESCHER
True Tone Saxophone

If you can whistle a tune you can learn to play a Buescher. 3 lessons given on request with each Buescher Sax' give you quick, easy start. Many learn scales first hour, tunes first week, with Bueschers.

Easy to Play — Easy to Pay

Take any Buescher Instrument home for six days' trial. See what you can do. If you decide to keep it, pay a little each month. Send for the Beautiful Catalog and the details of this liberal plan. No obligation. Mail the coupon today.

BUESCHER BAND INSTRUMENT CO.
2019 Buescher Block Elkhart, Indiana

BUESCHER BAND INSTRUMENT CO. 384A
2019 Buescher Block, Elkhart, Ind.
Gentlemen: Without obligating me in any way please send me your free literature. Mention instrument interested in.

Age?.....Name instrument.....

Name.....

Address.....

Hints on Using Taps and Dies

(*Continued from page 78*)

and consequently can be used anywhere that a regular hex nut will go. A set of these dies sometimes will save you the trouble of taking a motor apart. Another way in which these dies will help is by using them on your rough work so as to save your more expensive dies.

Before starting a tap, reference should be made to a tap drill chart to see if the proper size drill has been used.

Never use a monkey wrench or an S wrench except in cases where it is absolutely necessary, as in a corner when a small ratchet wrench is not at hand.

HAVE the work perfectly level and rigid before starting. Take care that you start the tap true. When the tap has caught, take a look to make sure that the tap is straight in the work. If it is not quite true, turn the tap backward and then forward again, pressing in the direction to straighten on the forward stroke only, and using an even pressure on both arms of the tap wrench.

When you are tapping steel, use a continual application of lard oil and take care not to force the tap. If the tap seems to stick, turn it back and start over again. This will loosen the chips.

Never use a large tap wrench on a small tap as you will probably break the tap.

Cast iron is best tapped dry as the chips crumble easily and do not form long curls. Never use machine oil as a lubricant on any kind of tapping; indeed, the tap will cut easier dry.

When threading a rod with a die, place it upright in a vise and file off any burrs that there may be on the end of the rod. Later, if the die does not catch well, take a file and make four flat bevels at equal distances around the end of the rod. This will enable two or three teeth to take hold at once. After the die is started, make sure that it is straight. Do not use much force on the die stock and use plenty of lard oil.

It frequently occurs that you want to have a tap cut oversize. There are several methods of doing this. One is to pack the groove with some cotton waste or a rag. Another is to heat the tap in boiling water and do your tapping with the hot tap. The first method is the better.

AN AGGRAVATING job is trying to remove a broken stud. The easiest method is by means of one of the several good screw extractors that are on the market, but one of these is not always available. Try pouring kerosene around the stud and let it stand for awhile. It will penetrate between the threads and usually loosen the stud. If a piece of the stud protrudes beyond the hole, it can be removed with a diamond point chisel and hammer. Then use a center punch to spot the center of the stud and drill it out with a drill slightly smaller than the size of the thread. After this is done, the hole should be cleaned out with a tap of the same size as the thread.

In the case of a hardened set screw, first heat with a blowtorch. Sometimes a broken stud that protrudes can be removed by simply filing it square; or filing a slot and using a screw driver.

Where the thread is a very fine one, trouble may be caused because the nut becomes stripped. A good way to get around this is to line the nut with soft solder. Then start it on the bolt and work it slowly downward. This really cuts a new thread inside the nut.

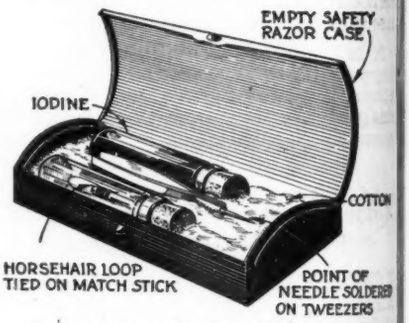
A trick worth knowing is how to make a screw hold in sheet metal. Take a punch with a sharp point and a long taper, the shank of which is the proper size for the tap you are going to use. Place the sheet metal over the hardie hole in your anvil or over a nut of medium size and drive the punch in at the desired point. This will make a short cylinder into which you can tap a couple of threads to serve for holding a small screw.

The illustration on page 78 indicates five errors in tapping, as follows: A monkey wrench is being used instead of a tap wrench. The tap has not been entered straight into the work. Instead of backing the tap out to straighten it, the workman is trying to force the tap toward him. The tap itself is a bottoming tap instead of a plug or taper tap; the taper and plug taps of the set of three taps are to be seen on the bench, if you look closely. Finally, the mechanic has machine oil at hand as a lubricant and it should not be used.

Pocket First Aid Kit

MECHANICS constantly are running splinters in their hands, getting cinders or chips in their eyes, or suffering other minor injuries. It pays, therefore, to have at hand a first aid kit. One of the most compact pocket kits is that illustrated. It is contained in a small safety razor case.

The tweezers have a short piece of



Besides iodine and cotton, the case contains tweezers, a needle point and a horsehair loop

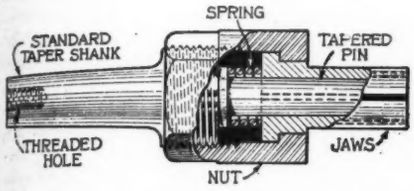
sewing needle soldered on the handle end, to aid in removing splinters. A horsehair loop, for taking particles from the eyes, is tied on a match stick and the stick is thrust through a cork so that the horsehair may be kept thoroughly sterile inside a small bottle. A fine enameled wire such as from the secondary of a Ford coil will serve in place of horsehair. Another bottle contains iodine for cuts and scratches. Cotton for use in applying iodine is packed tightly around the bottles.—D. S. JENKINS.

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Expanding Chuck for Use in Finished Holes

PINIONS, sprockets, or the like which have holes machined before the outside diameter is finished, can be handled efficiently in the chuck illustrated. The use of this chuck saves many trips to the arbor press, for the chuck stays in the spindle of the lathe and expands into the finished hole.

It consists of a shank to fit the lathe spindle, a tapered pin, a bushing split in



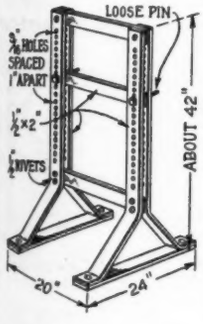
Device for holding work in which a hole has been machined before outside is turned

three places, a nut and a stiff spring. The bushing expands when drawn toward the spindle by the nut. The spring releases the jaws when the nut is loosened.

All parts are made of steel, and for severe use should be hardened and ground. Jaws to fit holes of several sizes can be made, if required, and used with the same shank. It may be advisable to tap the rear end of the shank for a draw-in rod.—G. A. LUERS.

Substantial Horse for Shop Use Made of Iron Bars

LONG bars in the power hack saw or on the drill press must have their free end supported. An empty carbide can is sometimes seen as the support, but it is seldom the correct height; and wooden horses such as carpenters use are easily broken in the machine shop.



Adjustable stand for supporting long stock

Illustrated is an adjustable iron horse made of flat bar iron that can be used in connection with the hack saw, drill press, shaper, or milling machine. Of course, if it is to be used for the miller, it will have to be made higher than shown. The joints are made with ½-in. rivets or bolts. —W. S. MILES.

Grinding Chucking Reamers

NEARLY all chucking reamers are made with unequally spaced teeth. It is well to bear in mind that if the cutting edges are ground as in a reamer with teeth evenly spaced, trouble will be experienced. There is only one way to grind such a reamer. The chamfer must be spotted off cylindrically to the required width and each tooth must be cleared to the edge by raising or lowering the set-up on every index. The reamer will then start cutting evenly.—H. J. C.

New
Water
open to you
GO WHERE nature is undisturbed . . . where the changing vista of the great Out-of-doors leads through mile after mile of unsettled country and winding waterways.
With a Johnson Motor astern of any good boat, you may cruise through chain after chain of charming water regions—fishing, hunting, camping as your fancy dictates.
This summer follow America's water trails with a Johnson. Four new 1927 models offer speeds of 8, 13, 22, and 29 miles per hour respectively—setting a new standard of water-motoring performance.
Send 10c in stamps or coin for our "Guide to Waterway Travels"—outlining over 50 charted water trips through the United States and Canada. Catalog sent free!
Johnson Motors sold by sport goods —hardware—marine supply dealers
JOHNSON MOTOR COMPANY
2538 Sample St., South Bend, Ind.
Export Division: 75 West Street New York, New York, U. S. A.
Canadian Distributor: Peterborough Canoe Company Peterborough, Ontario, Canada
Johnson National Demonstration Week
June 27th—July 4th
Water Motoring demonstrations. Free trial and rides. Races! Ask your dealer.
WORLD'S LARGEST MANUFACTURER OF OUTBOARD MOTORS
Johnson
Outboard Motors

THEFT INSURANCE

The ECLIPSE Nut Lock for disc wheels protects valuable automobile equipment from theft—for less than the cost of a new tube. The ECLIPSE is rust-proof, fool-proof and tamper-proof.

$3.00 each postpaid—specify make and size of wheel.

At your dealers—
or if he cannot supply you send his name and we will supply you direct.

ASSOCIATED INDUSTRIES CORPORATION
Pomona, Calif.

Wood In A Can
~may be sawed and worked with tools!

Surprising, yes, but here it is.

PLASTIC WOOD handles like putty as it comes from the can. It hardens on exposure to air into watertight wood which takes paint, stain, lacquer and varnish like any wood.

Use PLASTIC WOOD wherever wood needs replacing. Use it in boat construction, for repairing furniture, in cabinet work—in fact in any woodworking job.

Sold by Hardware and Paint Dealers—¼ lb., 35c; one pound, $1.00. Send coupon if they cannot supply you.

ADDISON-LESLIE CO.
30 Bolivar Street, Canton, Mass.

Please send me a trial quantity of PLASTIC WOOD for which I enclose 35c.

Name_____

Address_____

Name and address of Hardware Dealer_____

Morning to night—your hair smoothly in place!

"I Can't Get 'Em Up,—"

"I can't get 'em up in the morn—ing." So complains the bugler.

But *your* problem is different. Stubborn, pestiferous cow-licks—you can't make them *lie down* in the morning! And an hour or so after you brush your hair it's generally out of place again.

But that need not be so, today! You *can* keep your hair smoothly in place, all day long.

From Coast to Coast, the hair dressing more fellows use than any other is —*Stacomb*.

Stacomb not only keeps your hair looking right. It is also beneficial. Never leaves hair gummy nor sticky. Nor dried out, as frequent wetting with water makes it. And it helps to prevent dandruff!

Stacomb comes as a combing cream—in jars and tubes—and now in the popular new liquid form as well. All drug and department stores.

FREE OFFER **Stacomb**

Standard Laboratories, Inc.,
Dept. BC-9, 113 W. 18th Street, New York
Send me free sample of Stacomb as checked:
Original, cream form ☐ New liquid form ☐

Name.....

Address.....

PARKS
Manual Trainer
$35.00

For your home shop! Combination 11-inch band saw and 11-inch wood-lathe. If you have a knack for woodworking you can turn out first-class bridge lamps, cabinets, furniture, ship models, etc., in fast time. Get one!

Write for specification circular.

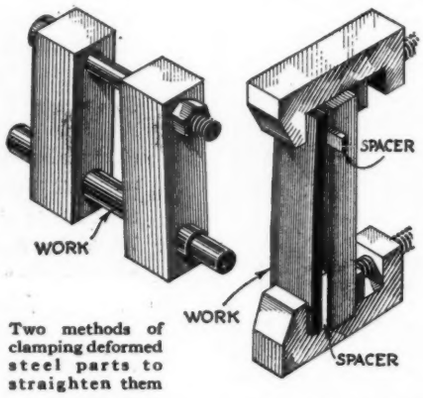
THE PARKS WOODWORKING MACHINE CO.
1547 Knowlton Street Cincinnati, O.

BURN YOUR NAME ON TOOLS
WITH THE
ARKOGRAF
Protect Your Tools From Theft. Write with electricity any name or design on the hardest and finest tools and instruments, or any metal, like writing on paper with pen or pencil. Complete Outfit $3.50 Prepaid Anywhere. Interesting illustrated circular free. Write today. Agents wanted.
ARKOGRAF PEN CO.
1171-A East Stark St., Portland, Oregon

How to Straighten Hardened Parts

MECHANICS do not generally realize that it is possible to deform hardened steel permanently by pressure applied while the part is heated at a temperature of anywhere between 500 and 600 deg. F., or from a deep straw to a deep blue. This little known fact can be put to good advantage in straightening parts that have become warped in quenching.

No matter how careful the heat treatment may be, there are always apt to be occasional parts, especially if the work is long and slender, that will become warped to an extent which will render them unfit for use. Rehardening such work often merely aggravates the trouble and, even if successful, is not best for fine steel. In many cases, however, such pieces can be straightened during tempering.



Two methods of clamping deformed steel parts to straighten them

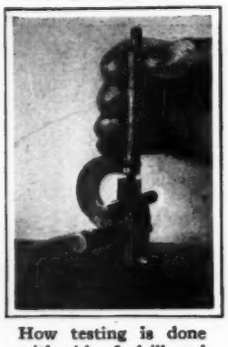
The writer has always done the straightening in a liquid salt bath, but no doubt it can be done, though less easily, over a flame. The part should be drawn to the highest possible temperature and allowed to cool again. The piece then is placed by means of clamps under a tension in a direction opposite that of the warpage.

Two of the many methods which may be used are illustrated. At the left, a small shaft is being straightened in a simple clamp made from a couple of blocks of cold rolled square stock and a bolt. At the right, a thin flat piece is being "ironed out" with the help of a pair of machinists' clamps and a stout bar. It will be noted that there is also a small spacer between the two pieces on top, to prevent overdoing the straightening. By placing such a spacer to one side only of the work, a twist can be taken out from a piece at the same time that the bend is removed.

Where a fairly heavy piece is considerably warped, it should be straightened by degrees by repeatedly subjecting it to the process, each time allowing the piece to cool until it can be touched. After the work is in the desired shape, it should be allowed to get entirely cold. It should then be re-heated a third time to the drawing temperature—the clamps, of course, having been removed—to show if there is any tendency for it to return to its former shape.

Judgment must be practiced in applying the corrective strain to the parts so as not to crack them. The writer has had occasion to reclaim by this simple process and at the expenditure of only a very little time in each case, some valuable pieces which would otherwise have been a dead loss.—HENRY SIMON.

Using Micrometer to Measure Work with Concave Face



How testing is done with aid of drill rod

ILLUSTRATED is a set-up of a micrometer with a short piece of drill rod held on the anvil to aid in checking a small part having one side concave. Two small parallel clamps grip the rod, while a larger clamp holds the smaller ones.

Sheet Metal Holder Keeps Acid Bottle from Spilling

THE accompanying illustration shows a sheet metal holder for bottles containing acid, gasoline, or other liquid. It can be set upon the bench alongside whatever work is being done.

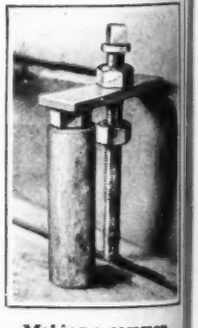
Acid bottle holder that tilts forward

The holder is so arranged that when the bottle is tipped forward the liquid comes out in drops through a groove cut into the cork. When released, it returns to a safe position. The holder is made of No. 16 sheet steel. The bottle clamp is lightly riveted to the frame.—ARTHUR KENDALL.

The bottle is held in a sheet metal clamp, which is pivoted in a light but rigid frame

Lengthening Short T-Bolts

OCCASIONALLY a job comes into the shop that requires the use of extra long bolts to strap it down on the machine bed. If these are not available, they can be improvised as shown from an ordinary T-bolt, two nuts and any screw of suitable length.

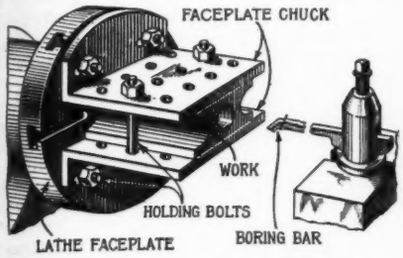


Making a common T-bolt longer

Using Twin Angle Plates to Mount Lathe Work

POSSIBLY there are some machinists who do not fully appreciate the usefulness of angle plates in connection with lathe work of a character similar to that illustrated. This is a casting that cannot readily be gripped with the usual four-jawed chuck. The first thought would be to send it to a boring mill, but if a mill is not available, some other method must be used.

To handle such a casting with angle plates, one of them is clamped to the



How to mount on a lathe faceplate work that normally requires use of boring mill

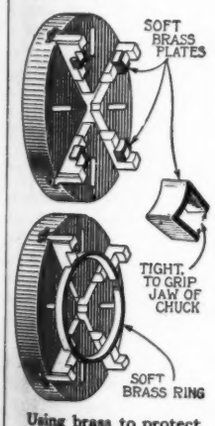
faceplate of a lathe and the casting put in place and centered approximately. Then the other angle plate is bolted on for rigidity.

The numerous holes in the plates can be used for bolts, or, if tapped, for set screws for locating the work more precisely. The angle plates can be made of cast iron, or in an emergency, of heavy steel plate.

Machining time on the lathe will frequently be less than on a boring mill, and another advantage of this method is that there are always more lathes available than boring mills.

Soft Jaws for Lathe Chuck

POLISHED parts requiring further machine work cannot be gripped by a lathe chuck without mutilation. Machinists have used cardboard shims, loose pieces of brass, and the like to prevent this. A better way is shown in the upper part of the accompanying illustration. Brass plates are formed to fit on the chuck jaws in such a way as to grip tightly and not slip off when the work is removed.



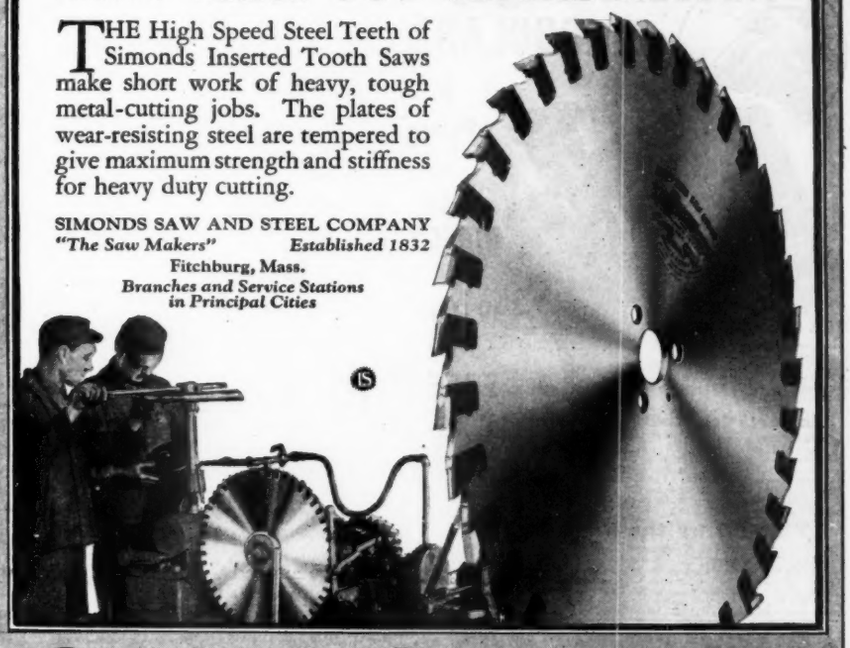
Using brass to protect polished work in lathe

The lower view shows a method more limited in scope, which may be more desirable where it can be used on duplicate work. A brass ring is made and split to allow it to open and close with pressure. This ring can be made fairly thick, and will distribute the jaw pressure over a large area. Properly made, it should open up to release the work when the jaws are loosened.—G. A. L.

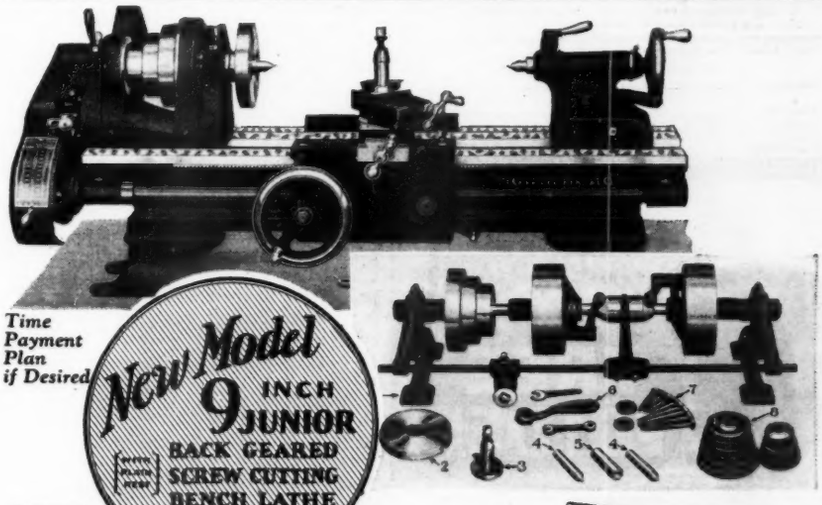
SAWS THAT CUT METAL FASTER

THE High Speed Steel Teeth of Simonds Inserted Tooth Saws make short work of heavy, tough metal-cutting jobs. The plates of wear-resisting steel are tempered to give maximum strength and stiffness for heavy duty cutting.

SIMONDS SAW AND STEEL COMPANY
"The Saw Makers" Established 1832
Fitchburg, Mass.
Branches and Service Stations in Principal Cities



SIMONDS
Pronounced SI-MONDS
SAWS FILES KNIVES STEEL



Time Payment Plan if Desired

New Model 9 INCH JUNIOR
BACK GEARED SCREW CUTTING BENCH LATHE
$160.00

Countershaft and Equipment Included in Price of Lathe

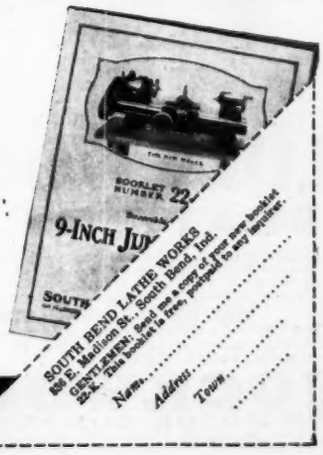
Has All These Practical Features

Back Geared Head Stock; Six Spindle Speeds; Power Feed to Carriage; 3-4 inch hole through Spindle; Plain or Graduated Compound Rest; Micrometer Graduated Collars on Cross Feed and Compound Rest Screws. Cuts screw threads 4 to 40 per in., left or right hand. Built in 2 1-2, 3, 3 1-2, 4 and 4 1-2 foot bed lengths, either Bench or Floor Legs. A precision lathe, limit of accuracy one thousandth (.001") of an inch. Weight 375 lbs.

The Lathe can be equipped with Motor Drive, operated by a quarter H. P. Reversing Motor that plugs into ordinary lamp socket. Comes complete, ready to use,

FREE BOOKLET 22-K—Just off the press! 24 interesting pages of practical lathe information. 133 photographs. Illustrates the lathe doing different classes of precision work, and describes various types and drives. A booklet of real interest and value to any Mechanic.

SOUTH BEND LATHE WORKS
836 East Madison Street · South Bend, Indiana
New York City Salesroom, 183 Centre St.; Phone Canal 9085


BOOKLET NUMBER 22
9-INCH JU
SOUTH BEND LATHE WORKS
836 E. Madison St., South Bend, Ind.
GENTLEMEN: Send me a copy of your new booklet 22-K. This booklet is free, postpaid to any inquirer.
Name.....
Address.....
Town.....

USE THE COUPON

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

SW

Far-Seeing Eyes
BINOCULARS

10 Power — Sold DIRECT — 10 Days' Trial FREE!

SEE MILES AWAY!
Conquer Distance! Bring people, scenes, ships, wild game RIGHT to YOUR feet—VIVID-LY! DOUBLE the thrill of dashing sports! ENJOY the grandeur of glorious Vistas!

Importation Received! Special Price!
COSTLY Binoculars—GENUINE prisms! Famous PREMIERE QUALITE lenses! Not 6, not 8, but 10-POWER (10 times magnification)—exquisite definition—brilliant illumination—wide field of vision—30 MM., making it possible to follow swiftly moving objects without moving the body. Complete with Leather Case, Neck and Shoulder Straps. Usually sold for $45.00 to $55.00. To feature our Optical Division and our "Direct-by-Mail" VALUES, we price it, for LIMITED TIME, at only $27.50

TESTED by the GOVERNMENT
Bureau of Standards at Washington. Used by Army and Navy Officers and Commanders. Suited for aerial and long distance observation! We are selling thousands at this Special Bargain Price to big Game Hunters, Globe Trotters, Explorers, Tourists, Motorists, Naturalists, Mountain Climbers, Sportsmen—men and women all over the World! DON'T MISS the Pleasures that BINOCULARS will give you! ORDER YOUR PAIR—TODAY!

Our Plan is Different! It is arousing nation-wide comment. We ask for NO money in Advance. Nothing on Delivery. We send BINOCULARS for 10 Days' trial Absolutely FREE to responsible persons.

If pleased, you may pay on Budget Plan:
$6.00 MONTHLY
or, if you prefer to pay cash at end of 10 DAYS, deduct $2 and send Check or Money Order for $25.50 in FULL SETTLEMENT. Otherwise return them. Order NOW! Limited Quantity! $25.50

SEAVER-WILLIAMS CO.
Importers, Exporters, International Mail-Order House
"2 Generations of Honorable Dealings"
365 WASHINGTON STREET, BOSTON, MASS.
Largest Retailers of Binoculars in the World.

Gentlemen:—Send me $27.50 BINOCULARS 10-POWER for 10 Days' FREE Trial on the above plan.

Name _____

Address _____

Clip and mail this adv. NOW. If a new customer, please tell us something about yourself. We will appreciate and respect the information. THANK YOU. Pop. S. 7-27

Ready for You
FREE FOLDER

TELLS ALL ABOUT THE
15 New Features
as well as the many other features of the wonderful Motor that thrilled the world in 1926 by its remarkable speed and power. You will want to know especially about "The Pilot"—a NEW device that steers your boat in any course you choose—straight or curved, without attention from anyone. Leaves you free to cast, or troll or rest. The New—

LOCKWOOD
FORMERLY
BOAT LA MOTOR
also offers you many other advantages—improvements in Power, in Speed, in Ease of Starting, in Stopping, in Convenience and Durability. Find out all about them before you choose any Motor. Get the facts now.

WRITE FOR FREE FOLDER
Just out—See how Lockwood is blazing the way by advanced engineering methods backed by 23 years of marine engine building experience. (24)

LOCKWOOD MOTOR COMPANY
717 Jackson St. Jackson, Mich.

His Strange World Came True

(*Continued from page 38*)

furnaces with enormous calorific power . . . Water will be the coal of the future."

Needless to say, here Verne fell into the same error as the inventors of perpetual motion machines. He did not realize that it would take, theoretically, an equal amount, and, practically, a greater amount, of energy to decompose water into hydrogen and oxygen, than the two gases so obtained could generate by their reunion. But think when Verne wrote this!

And—getting back to his balloon story—who knows but that men may yet be able to spend five weeks in a balloon, and cross a continent?

THE greatest of Verne's stories of the conquest of the air is "Robur the Conqueror," which appeared in 1886. Even at that time Verne anticipated the controversy between proponents of lighter-than-air machines and advocates of the heavier-than-air type. In "Robur the Conqueror," Verne has the inventor of a heavier-than-air machine kidnap two champions of the lighter-than-air type, and take the amazed victims on a nonstop flight practically around the world. The two kidnaped men finally escape—still unconvinced—and build a lighter-than-air machine. Verne's climax is reached when this lighter-than-air dirigible, making its trial flight, is crashed into and brought to earth by the heavier-than-air *Albatross*. The scientific prophecy which Verne made was the prediction that the heavier-than-air type would prove more practicable than the lighter-than-air type.

To date, Verne has been correct in this prediction—although the matter is not yet settled. Experiments are today being made with the rigid dirigible which may bring the lighter-than-air type into the lead.

The fascinating thing about "Robur the Conqueror" is Verne's description of his aircraft of the future, the *Albatross*—a flying machine with a body of compressed paper, lifted and held in the air by seventy-four horizontal screws and propelled by electric motors actuated by batteries of "secret" composition.

THE most obvious error in Verne's guess was in connection with the nature of the power employed. Again, the expectation suggested in "Five Weeks in a Balloon"—namely, that battery units of tremendous power, in proportion to their weight, could be devised—is evident. Verne apparently had the idea that substances would be discovered which would give an almost inexhaustible flow of electricity merely by means of the chemical energy contained within them. Verne's airship might be compared with an electric automobile whose battery never needed recharging. Unfortunately, there "ain't no such animal" yet. Furthermore, if such batteries should be devised, the weight of the necessary motors alone would be greater than the weight of a gasoline engine capable of producing equivalent results.

It was the "explosive mixtures capable of producing mechanical motion"—which Verne discarded—which actually became the motive power of the modern airplane. But how could Verne have guessed that in 1886? Although the gas engine had been invented nine years before, it was still little more than an experiment. Steam had by that time been tried out, and he recognized its limitations. Electricity was just coming into its own, and it is not strange that Verne expected it to perform miracles of which present scientific knowledge shows it incapable.

The screws mounted on perpendicular axes, which enabled Verne's machine to rise straight from the ground without any forward motion whatever, have not materialized. In this, did Verne make a mistake?—or was he even ahead of our own time? Inventors are still working on this idea today—the helicopter. Thus far they have been only partly successful. But can we say that it cannot—will not—be done?

In 1905—the very year of his death, when Jules Verne was seventy-seven years old—he wrote a third story of the air, which he called "The Master of the World." In this he described a machine capable not only of flying in the air but also of sailing on water, traveling under the water, and bounding along roads at 120 miles an hour! In short, *The Terror*, as he calls the contrivance, is a combination submarine, automobile and aircraft! We of today have less reason to laugh at such a conception than had readers at the time the book appeared. For the airplane-automobile has been produced experimentally, the flying boat is in daily use. Who is to say the rest of his prophecy is not to be fulfilled?

Even by 1905, Verne had not given up his idea that electricity would prove to be the master motive power. In the story, the "head inspector in the federal police department," taken prisoner on board *The Terror*, says:

"THE power by which the machine was driven was neither steam nor gasoline. No doubt it was electricity, generated on board, at some high power. Naturally, I asked myself whence comes this electricity, from piles, or from accumulators? But how were these piles or accumulators charged? Unless, indeed, the electricity was drawn directly from the surrounding air or from the water, by processes hitherto unknown."

At this, we laugh. But—

Should we?

Of course, Verne, in his "Master of the World," is wildly melodramatic. He has *The Terror* enter an automobile race, the finish of which was at Chicago—win the race at 120 miles an hour, and disappear into Lake Michigan! He has it flee from two submarine destroyers at Buffalo (there are no destroyers at Buffalo, and never were) by diving down the Niagara River—and, just as it was about to go over the Falls, taking to its wings and flying away!

Nevertheless, much can be said in Verne's defense. He began his prophecies of inventions in the sixties. By 1905—when he wrote "The Master of the World"—mechanical invention had progressed at such an unprecedented rate that Verne no doubt felt himself justified in assuming that the future would bring new inventions at a still more rapid pace.

WHAT happened, as we of course know, was that the years 1905 to 1927 have been utilized not so much in discovering utterly new principles, as in perfecting the application of principles hitherto discovered.

But what of the future? What of electrons, radio-activity, and the relationship between electrical energy and the constitution of the individual atom? Scientists tell us, today, that the atom contains within itself more energy than Verne imagined in his wildest dreams! Some day may we not learn how to get at that energy, and put it to work?

So we cannot be sure that Verne was really wrong, even as to his strange assumptions concerning sources of electrical energy.

EXPERIMENTS using a million volts will shortly be made with cathode rays, according to a recent announcement of Dr. A. Lincoln Marshall, of the General Electric Company, associated with Dr. W. D. Coolidge in the development of the cathode ray tube. So far the highest voltage applied has been half a million.

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Does work of 2 tools!

$2

At all leading hardware dealers. Or write us.

This perfectly balanced 1-pound hammer is made of tool steel. It has chisel-edged claws, without altering the claw feature. It has two small claws right and left to reach close corners next to wall. The head is correctly balanced making it possible to remove 10's at one pull. Write for fully illustrated folder.

Chisel-Edge Claw Hammer Co.
H. A. Ayvad, Hoboken, N. J., Dept. E

CHISEL-EDGE-CLAW HAMMER

A 2c STAMP —will start you on the road to success. See Money Making Opportunities on pages 116 to 135.

Why Suffer With That Pain

This moderately priced **Therapeutic Lamp bakes out pain.**

Physicians highly recommend it for treatment of Rheumatism, Neuritis, Lumbago, Bronchitis, Stiff Neck, Ovarian Cholic, Chest Colds, Neuralgia, and all pains caused by congestion and poor circulation.

Complete with 260 Watt Bulb, 8 feet of cord, two piece standard plug; can be attached to any regular electric light socket. Shade and reflector made of aluminum, diameter 7 1-2 inches.

Send no money, pay postman $5.00 (plus a few cents postage) on receipt of lamp.

DANIEL LEVY
2353 82nd St. Brooklyn, N. Y.

Rider Agents Wanted

Select from 44 Styles, colors and sizes of Mead Bicycles. Ride and exhibit sample and make money.

Factory to Rider We ship on approval for 30 Days' Free Trial, direct from FACTORY. Bicycles from $21.50 up.

Tires Lamps, horns, wheels, parts, equipment, and repairs at half usual prices. Bicycles from $21.50 up.

Mead Cycle Company Dept. P-250 Chicago Write us today for free catalog

TWO FREE BOOKS

Breed squabs and make money. Sold by millions at higher prices than chickens. Write at once for two free books telling how to do it. One is 40 pages printed in colors, other 32 pages. Ask for Books 3 and 4. You will be surprised. Plymouth Rock Squab Company, 616 H Street, Melrose Highlands, Massachusetts.

BUILD AND FLY A **MODEL AEROPLANE**

Learn the principles of Aviation with an accurate model of a real 'plane. Ideal Scale Drawings and Building-Flying Instructions show you how. Drawings and Instructions for any one of the following 'planes sent postpaid for 25 cents: Fokker North Pole Plane; Curtiss JN4D-2 Training Plane; DeHavilland Plane; NC-4 Seaplane, Blériot, Nieuport or Taube Monoplane; or Cecil Peoli Racer. 48-pp. Catalog of Parts and Supplies—5c p. p.

IDEAL AEROPLANE & SUPPLY CO.
163-165 Spring Street New York City

Floods Challenge Science

(*Continued from page 19*)

crest of waters began its advance down the lower river.

Strange to say, most experts agree that the very earthworks the inhabitants have built are the source of greatest peril during a flood like this. Time was, before white men came to America, when the great river went its own good way, and settled its own flood problems by spreading out over the land where it willed. But with advancing civilization men have pushed the river back, guiding it by two thousand miles of embankments into an ever narrowing channel, reclaiming fertile farm lands. Silt deposited on the river bed has further restricted the channel room for the flow of water. And so men have had to build the levees higher and higher. In recent times $10,000,000 has been spent every year to raise the dikes.

IT IS because the levees have failed time and again that engineers have proposed other plans for controlling the floods. One of these would call for the establishment of huge reservoirs at points along the main stream and its tributaries, into which excess waters could be drained. To this plan the objections have been raised that such reservoirs would render worthless immense areas of rich farm land; that the cost would run into billions and would be out of all proportion to the partial relief that might be given; and that the reservoirs could not be relied upon to be empty when most needed.

Another proposal is for spillways at intervals in the levees, with channels to lead the excess water to other streams or to the sea. This, in effect, was the purpose of the engineers recently when they deliberately dynamited the Poydras levee below New Orleans in an effort to save the Louisiana city by lowering the water level. The chief objection to this plan is that the relief is only temporary and local.

Reforestation of cleared lands has been suggested. Indeed, the denuding of forests is held by many as the primary cause of the Mississippi floods. To this engineers reply by recalling that the worst flood ever experienced in St. Louis occurred in 1844, when the virgin forests had barely been touched. Weather observers add their records to show that the high waters on the average are no higher than they were half a century ago. Where forests have been cleared, they point out, farming has kept the soil so broken and permeable or so covered with vegetation that it absorbs rainfall about as effectively as forest land, if not better.

THUS the majority of engineers and scientists who have studied the problem have fallen back on the strengthening of the levee system and the deepening of river channels as the greatest hope for the future. What they urge is the construction of a great new system of dikes designed scientifically to withstand pressure greater than the greatest conceivable flood can produce.

Today the levees are little more than banks of earth rising forty feet and more. In some places they are reinforced with planking, brush, or concrete piling. In flood time they are topped by bags of sand. As the flood pressure grows, armed guards patrol the embankments, ever watchful for muddy seepage, first sign of a leak. Sandbags sunk on the river side of the levee may stop the leak in time.

The whole tragic battle with the Mississippi has been one of courage and resourcefulness against overwhelming odds, fought from behind ramparts that are penetrable and scientifically out of date. Like every other war against a powerful enemy, it will not have been in vain if it inspires new determination to build defenses that will withstand all tests.

NEW!

~and already winning Nation-wide Popularity

Indian SCOUT 45

~the police special and sport solo

VETERANS praise it. New riders welcome it. Already a coast-to-coast motorcycle sensation. That's the startling story of the new Indian Scout 45—a mount winning thousands to the biggest thrills of motorcycling.

For real, rugged outdoor sport, hop on the Scout 45. It's the steadiest, sturdiest, snappiest mount you ever rode!

Ride the 45 a Mile

The Scout 45 has a superpowerful motor, almost instant acceleration, large oversize brake, classy sport handle bars. Holds boundless power for the veteran rider, easy handling features for the novice. Guides you quickly through traffic—out to the open—anywhere, anytime—safely! Ride the 45 a mile—and find the full meaning of its amazing country-wide popularity.

Easy to Own

Call on your nearest Indian dealer and find how easily you can own a Scout-45 under our generous pay-as-you-ride plan. Or mail coupon below for the complete interesting story of this popular model.

DEALERS!
A few good territories open. Our proposition is a winner for ambitious men. Write now.

Indian Motocycle Co.
Dept. H-7, SPRINGFIELD, MASS.

Indian Motocycle Co.,
Dept. H-7, Springfield, Mass.

Send me FREE descriptive circular on the new Indian Scout 45. This places me under no obligation.

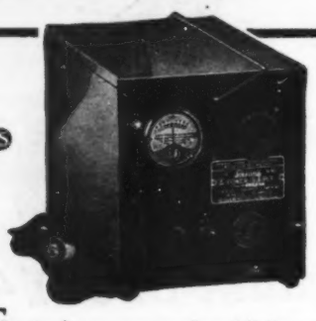
Name_____
Address_____
City_____ State_____

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Announcement

Sterling

"A" LIGHT-SOCKET POWER UNITS



They're here—two perfected light-socket power supply units—eliminators of all "A" batteries and chargers.

Two models—R-96-Raytheon for 6 volt and R-94-G. E. bulb for 4 volt, Radiolas especially.

Sterling model R-96 is universal for all sets using 3 to 10 large tubes. Employs Raytheon's new 2½ ampere rectifier. No heat—no bulb—no breakage—long lived.

Sterling indicator makes this unit adjustable to point of highest operating efficiency and lowest power cost.

These units have two stages of filter, large capacity, smoothing out the last trace of hum.

Automatic switch gives instant control of all power when used with "B" eliminator or "B" batteries.

One installation, one adjustment—and your "A" troubles are ended. Ask your dealer to show you this remarkable Sterling "A" Power unit.

Sterling

"A" POWER UNITS

The Sterling Mfg. Company

2831-53 Prospect Ave., Cleveland, Ohio

Dealers—Don't miss the complete Sterling display at the Chicago R. M. A. Show, Booth 68.

RMA Radio Manufacturers Association Member

THIS 100 PAGE RADIO CATALOG FREE

"Build your own with "RASCO" Parts"

Radio Specialty Co., 96-P Park Place, New York, N.Y.

Canned Food and Your Health

(*Continued from page 22*)

cation of the various vitamins, without which the finest food combinations seem useless."

Dr. Eddy is the only scientist who claims he has really seen a vitamin, for these substances are really chemical ghosts, invisible to the eye. Dr. Eddy believes he has isolated the vitamin of yeast; that the white crystals resembling snowflakes, in his test tube, is that. If Dr. Eddy's "bios" is really a vitamin, it shows they are probably necessary to plant as well as animal life, for yeast is a plant.

Though Dr. Eddy's bios is the nearest scientists have come to seeing a chemical ghost, they are sure, thanks to thousands of white rats who have died a noble death, that five such ghosts exist. They are labeled A, B, C, D and E. In fact, the first vitamin discovery was due to rats, for Dr. McCollum, trying to discover the relative feeding values of "pure" carbohydrates, protein and fats, found the rats thrived on none of them, and apparently needed some other element. When he switched to milk and green vegetables, the rats perked right up. The chemical ghosts, then, were in these foods, a fact that had never been actually ascertained before, though people had known for a long time that milk, fresh fruits and vegetables were good for them.

IN THE twenty years since Dr. McCollum's first discovery, doctors and scientists have finally reached definite conclusions about the vitamins, as follows:

Vitamin A, or the antixerophthalmic. Necessary for growth. Its lack causes eye ailments. Found in milk, eggs, animal fat and fish oil, particularly cod liver oil, which has 200 times as much vitamin A as butter fat. Also found in fruits and vegetables, including spinach, chard, cabbage, lettuce, water cress, asparagus, yellow corn, millet, carrots, sweet potatoes, parsnips, mangoes, beans, green peas, bananas, apples and tomatoes, the latter being very rich in it.

Vitamin B, prevents beri-beri or polyneuritis. It was first discovered during the Russo-Japanese War when Japanese sailors eating mostly polished rice and fish, came down with beri-beri. Change to unpolished rice helped. This vitamin is present in unpolished rice, whole wheat bread and breakfast food, yeast, most seeds, vegetables, fruits, nuts and dairy products.

Vitamin C, the antiscorbutic or scurvy preventive, is found in most fruits, green leaves and tubers, particularly in cabbages, lemons, oranges, tomatoes, apples, strawberries, carrots, peas, bananas, spinach, grapefruit and corn. It is in milk if the cow has eaten green food. Its presence in citrus fruits accounts for their being taken on long sea trips. They prevent scurvy

VITAMIN D, the antirachitic or enemy of rickets, controls the deposit of calcium in the bones. It occurs in fish oil, particularly cod liver oil, egg yolk, milk and some vegetables. Cod liver oil has been found efficacious in treating rickets in children.

Vitamin E, the most recently discovered, is called the antisterility vitamin. It is believed to be the secret of large families, and is found in the wheat germ, vegetable oils, fresh meats and salad vegetables, especially lettuce.

These are the five vitamins in good standing with the medical profession. Others may be in existence, and at the rate at which vitamins have been found in the last few years, there is every reason to expect new discoveries. Doctors believe that more and more use will be made of the new life-giving substances in the treatment of the numerous dietary diseases and ailments. The human race travels on its stomach, and if that can be kept working, the rest of the body is apt to follow.

So Grandma Jones found she needn't worry about canning taking away all her vitamins. After all, vitamins come in cans, she found—sometimes more in cans than in kettles. Good canners see to that. All that she needs to do is get reliable canned foods and stop worrying. Nature will do the rest.

Couriers That Never Fail

(*Continued from page 26*)

from the landing board of its loft into the trap, or coop. For a homing pigeon that lingers outside its loft is like a race horse that stops a hundred feet or so from the finish. When the homer has learned this important step, he is taken out for trial flights. These begin a few feet from the landing board and are gradually lengthened until, at the end of ten days, he is being tossed from a point a mile or two away.

NEXT come flights from points five, ten, twenty, fifty, and even a hundred miles away. The pigeoneer weeds out the stragglers, or birds that don't find their way back to the loft in good time, for all good lofts—especially in racing—are built on the inexorable law of the survival of the fittest. The long distance flights take place in the fall. Some of these are over 500-mile courses, some over shorter distances. Many birds that are unbeatable at 500 miles show little or no speed in the shorter races. The pigeon that can cover 500 miles in a day, however, is the one that commands a price of $500 or more when put up for sale. A bird that won the San Sebastian, a blue ribbon race of 648 miles from Spain to England, in 1920, was sold to Louis Heitzman, of Louisville, Ky., for $1086. But it took fifty years of scientific breeding to produce that pigeon.

The homing pigeon's contributions to the happiness and welfare of mankind are many and varied. In sparsely settled sections of Arizona, Texas, Nevada and Montana many physicians find it practicable to use them as messengers between themselves and patients living in distant and lonely places, where there are neither telephone nor telegraph lines. One doctor in Arizona always takes two birds with him when he goes to these distant places. After treating his patient, he leaves the pigeons with the family with instructions to release one of them in the morning after placing a red band on its leg if the patient is worse, a white one if he is better, and a blue one if his condition is unchanged. The second pigeon carries another message later.

THE use of homing pigeons by Arctic explorers and by members of expeditions into unexplored sections of the world has resulted in many thrilling rescues and the saving of many lives. Boom towns on our own frontiers, especially in Alaska, have found the feathered beauties of great value during those periods between the establishment of the "town" and the opening of modern lines of communication. Only last year homing pigeons were used to summon medical assistance to a new settlement on Dime Creek, Alaska, when half the miners were suddenly stricken with ptomaine poisoning.

Homing pigeons can stand freezing weather, high winds and even hail, but they can make little or no headway in rainy weather despite the fact that they are game to the last drop of blood in their tiny bodies.

fix it yourself all you need is heat

If a household utensil goes wrong—Solder it!

It's a regular hobby with thousands of people—to fix things themselves. And now, with Kester Metal Mender men, women and boys actually solder!

You too, can use Kester Metal Mender expertly right in your own home. Kester requires only heat, is easy to use, and it's a genuine solder, too! It carries a scientific flux inside itself. Like the lead in a pencil, this flux does the work.

If a part of a car or tractor goes wrong—Solder it!

Think of how many useful things you could put back into service with just a touch of Kester, here and there.

If you have electrical wiring to do—Solder it!

Buy a can today from your hardware dealer, general store, auto supply shop or druggist. If you want to be convinced without expense—write for Free Sample.

KESTER METAL MENDER

The Household Solder

CHICAGO SOLDER COMPANY
4207-09 Wrightwood Ave., Chicago, U.S.A.
Established 1899

CARTER

New Resistors

Half Size

Made in all types for all circuit requirements. See them at your dealers. Send for illustrated folder of circuit suggestions.

CARTER Resistors

In Canada: Carter Radio Co. Ltd., Toronto

MEMBER RMA

CARTER RADIO CO.
CHICAGO

INDISPENSIBLE

for 100% Tube Efficiency

Only Amperite supplies automatically the self-adjusting filament current your tubes require. Eliminates hand rheostats. Simplifies wiring. Insist on Amperite. Accept nothing else. Price $1.10 complete. Sold everywhere. Write for Free Hook-Ups and construction data to Dept. P. S. 7

RADIALL COMPANY
50 Franklin Street
New York City

AMPERITE

REG U.S. PAT. OFF.

The "SELF-ADJUSTING" Rheostat

A Vision of Aviation's Future

(Continued from page 33)

radio compass, enabling them to locate their positions and chart their courses in the thickest weather; liners come into New York harbor as safely by night or in fog as they do by daylight, guided by the induced currents from a tiny electric cable laid along the bottom of the Ambrose Channel.

With a device to keep the airplane on an even keel and the radio compass improved, mail planes will fly by night as safely as they do by day, and it will be a simple step to guide them to their landing fields by means of just such an electrical device as that used in New York harbor. An induced current from a wire running to the field would deflect a needle to the right or left, indicating that the flyer was off his course, while the intensification of the current as the plane approaches the field can be indicated. By some such means as that, mail and interurban aerial service will become a night-and-day affair.

I LOOK forward, too, to steady development and increased use of the flying boats, for crossing the Great Lakes, wide bays and gulfs, and flight along river courses. This is the safest form of air travel yet devised, for in case of a forced landing from any cause there is the buoyant medium of the water to float upon. The chief danger here is from storms so severe as to wreck the craft by the action of the wind upon the wings. Nine times out of ten flying boats forced to land on a rough sea have been unable to rise again, because of the waves, of damage to propellers or wings, or of being out of gas.

To overcome this handicap, we built, during the war, what may be called the flying lifeboat. This is a flying boat with discardable wings, with a small auxiliary motor and a water propeller. After alighting on the rough water, the wings are detached and left behind. The hull is built like an unsinkable lifeboat. If the air propellers are not damaged, they may furnish motive power to get the craft to land; otherwise they can be thrown over and reliance placed upon the auxiliary motive power and sea propeller to keep the boat head-on to the waves and eventually bring it into port.

Air fighting in the next war will be vastly different from air fighting in the last war; safer, too, for the actual combatants. Much that we learned about military aviation in the last war was put into practical form too late to be of service before the armistice. For example, there was the aerial torpedo. We built twenty-five of these, but none. so far as I know, ever got to the front. Few persons ever knew anything about them.

THE aerial torpedo is a pilotless airplane, controlled by radio, filled with high explosives calculated to drop, with its load, after a given number of miles or upon an impulse transmitted to it. We built some of each type. The rudders and elevator are controlled by a clockwork mechanism, which in turn responds to radio impulses from without; balance is maintained by a gyroscope which gets its power from a servomotor actuated by the wind as the machine flies. The controlling mechanism was the invention of Lawrence Sperry, who gave much to aviation and finally lost his life in a flight over the English Channel.

Bombing will be done in the next war by these aerial torpedoes, launched from perhaps a hundred miles from the objective, impervious to enemy attack unless struck in a vital part of the mechanism.

Fighting airplanes in the next war will have no "blind spot" from which an enemy plane can attack with impunity. That was one of the last war problems put up to us for solution. We built a pursuit triplane *(Continued on page 114)*

Amplion Cone

Cabinet Model AC12. . . $30

"The reproducer is the most vital adjunct to a radio installation"

Yet nine people out of ten buy speakers without making any comparisons.

You will appreciate your Amplion even more after you have heard it in comparison with others.

Make a test!

If your dealer has no Amplion Cone in stock to give you a demonstration, write to us for the address of one who has.

Amplion has the most complete range of radio sound reproducers on the market. Models range all the way from $12 to $135 to fit every radio set and every purse.

THE AMPLION CORPORATION OF AMERICA
280 Madison Avenue
New York

The Amplion Corporation of Canada, Ltd., Toronto, Ont.

AMPLION

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Must Men Suffer *after 40?*

AN AMERICAN scientist has made a discovery that touches the very keynote of health, vigor, and welfare of men past 40. He has found a simple home treatment for prostate gland trouble.

No Medicine

Without medicine, surgery, violet rays or trick treatments, he has found a way to directly stimulate the prostate gland—often driving out the congestion and making it function its normal way. So great has been the success of this treatment that an organization has been established to furnish it to the millions of men who are in need of it.

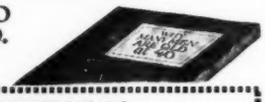
2 Out of 3 Men

Are you one of the 2 out of 3 men who have prostate trouble at a certain age, according to many medical authorities? Many are victims without knowing. Very often such conditions as sciatica, aches in back, feet and legs, frequent nightly risings, chronic fatigue, depression and weakness are symptoms.

FREE Book

This institution has published a little book, "Why Many Men Are Old at 40" which reveals amazing facts about old age. If you suffer with prostate trouble, it may be a godsend to you. While the edition lasts it will be mailed Free. Don't go on with conditions that may lead to surgery—or that take the pep, energy and joy of living out of life. Mail the coupon below immediately to

THE ELECTRO THERMALCO.
4071 Main St.,
Steubenville, O.



THE ELECTRO THERMAL CO.
4071 Main St., Steubenville, Ohio.

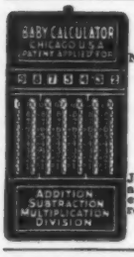
Please send me Free, and without obligation, copy of your booklet, "Why Many Men Are Old at 40." Mail in plain wrapper.

Name_____
Address_____
City_____

Western Address
Suite 40-P, 303 Van Nuys Bldg., Los Angeles, Calif.

Make More Money

Read the Money Making Opportunities on pages 116 to 135 of this Issue.



ADDING MACHINE

New Pocket Size, does work of $300 machine. Guaranteed 5 years. Made of Steel, not a Toy.

FREE TRIAL
SEND NO MONEY
$2.50 TOTAL COST

Just name and address. We will ship immediately. Pay postman $2.50 plus postage on delivery. If not satisfied after 10 day trial money refunded. Agents wanted.

BABY CALCULATOR SALES CO.
P. O. Box 1118, Chicago, Ill., Dept. 16

THE VEST POCKET LAWYER

A complete law course—clearly analyzed in understandable English. It is a daily guide—a manual of reference for the business man—the law student—the justice of the peace—the notary public—the farmer—the clergyman—the merchant—the banker—the doctor.

360 pp. Price $1.50, postpaid

POPULAR SCIENCE MONTHLY
250 Fourth Avenue, New York City

MAKE BIG MONEY

Results Quick—Part or Full Time. Take up poultry raising. It's interesting, healthful, PROFITABLE. Easy to sell all you can produce at big prices. Our new course by Henry M. Lamon, former gov't expert, gives short cuts to success. Write for free book, "How to Raise Poultry for Profit."

NATIONAL POULTRY INSTITUTE
Dept. 413 Washington, D. C.

Learn Cartooning

At Home—In Your Spare Time from the school that has trained scores of today's successful cartoonists who earn from $50 to $200 and more a week. The Landon Picture Chart Method of teaching makes original drawing easy to learn. Send 6c in stamps for full information and chart to test your ability. *Also state age.*

THE LANDON SCHOOL
1451 National Bldg., Cleveland, O.

Travel on "Uncle Sam's" Payroll

RAILWAY POSTAL CLERKS
MAIL CARRIERS

$1700 to $3000 Year

Many U. S. Government Jobs Obtainable

MEN—BOYS, 17 UP SHOULD MAIL COUPON IMMEDIATELY

Steady Work. No Layoffs. Paid Vacations.

COUPON→ FRANKLIN INSTITUTE
Dept. K-265, Rochester, N. Y.
Sirs: Rush to me without charge: (1) Specimen Railway Postal Clerk Coaching; (2) FREE 32-page book describing U. S. Government positions open to men and women and full particulars telling how to get them.

Name.....
Address.....

A Vision of Aviation's Future

(*Continued from page 113*)

having an opening in the bottom of the fuselage, at the rear, through which a machine-gunner could operate his weapon while in flight in case an enemy plane got "on his tail." The radiators were placed on the sides, and the action of the wind upon them produced a sound which gave this plane the nickname of "Whistling Billy." "Whistling Billy" was begun only a few months before the Armistice and was not finished in time to get to the front.

Doubtless there will be hundreds of undreamed-of developments in flying in the next few years. In some directions we have gone further in the nineteen years since I flew the *June Bug* than anyone then dreamed possible; in other directions aviation has not come anywhere near the visions of its pioneers, and I doubt, as I have already said, whether some of those dreams ever will be realized.

Of one point, however, I feel certain. The dirigible will never dominate the field of aviation, and is not comparable with the airplane. Lighter-than-air craft has proved itself too fragile, too unwieldy, too expensive in every way, to compete with the airplane.

Wireless Power

(*Continued from page 11*)

reflected from a mirror as a beam—the polished copper reflector of your portable electric heater is for that very purpose. Thus you might expect with good reason that radio waves, at least the short ones that approached nearest to the character of heat waves, might be reflected in the same way. You would be right.

Heinrich Hertz, who discovered the existence of radio waves, succeeded years ago in focusing extremely short radio waves to a beam. In his laboratory he set up reflectors six feet in diameter, made of pitch and wax and modeled in the same parabolic or curved, somewhat cone-shaped, form used in the reflectors of automobile headlights.

IMMEDIATELY he found he could project a six-foot-wide radio beam across his laboratory. With his parabolic mirrors, Herts was able to focus radio waves up to sixty-six centimeters—about two feet—long. This is close to the practical limit. Radio waves commonly used for broadcasting, often a quarter of a mile long, cannot be reflected in a mirror of reasonable size, for to give best results the wave must be considerably smaller than the mirror. But it is easy to produce short waves. In fact, a few years ago two radio experts, Dr. E. F. Nichols and J. D. Tear, succeeded in creating radio waves so short that they lapsed into the heat-wave band. These waves were only a hundredth of an inch long!

For radio power, then, it is readily possible to obtain a short wave capable of being shot as a straight, narrow beam from a parabolic mirror, as Dr. Thomas proposes. One remaining difficulty still stands in the way—the shorter the wave, the less power can be put into it! The very construction of the vacuum tube that generates the wave makes loss of power the inevitable result of an attempt to shorten the wave length, unless some way can be found to prevent the tube from burning out under increased current. This is the problem that Dr. Thomas faces, and that he has already gone far toward solving.

When he lit his lamps by radio before the New York Electrical Society, he was using a vacuum tube that embodied the best combination he has yet (*Continued on page 116*)

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

LOFTIS BROS. & CO.
108 N. State Street Chicago, Ill.
Dept. B871
Diamond Catalog Free; send now for big 132-Page Book

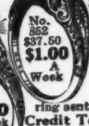
CASH OR CREDIT

Diamonds
GENUINE—GUARANTEED

No. 12 $150 $3.75 A Week

No. 27 $75.00 $1.75 A Week

No. 849 $97.50 $2.50 A Wk.


No. 852 $37.50 $1.00 A Week

No. 21 $200 $5.00 A Week

Quality Gifts

The Quality Diamond Gift is the most prized of all. Every article we sell is of finest grade. You always get the best value from Loftis. Satisfaction guaranteed or money back. The Diamond Rings shown here are all exquisite creations in solid 18-k White Gold, set with sparkling blue white Diamonds of fiery radiance. Any ring sent for your free examination on request.

Credit Terms: Pay one-tenth down; balance in weekly, semi-monthly, or monthly terms at your convenience. All goods delivered on first payment.

Railroad Watches—Guaranteed to Pass Inspection
HAMILTON NO. 992. 21 Jewels, Adjusted to 5 Positions. Gold filled 25-Year Case $55
ELGIN'S LATEST RAYMOND 21 Jewels, 8 adjustments. Runs 40 hours one winding. Gold filled 20-Yr. Case $55
ILLINOIS "BUNN SPECIAL" 21 Jewels, Adjusted to 6 Positions. Gold filled 25-Year Case $50
Railroad Watches sold on our regular credit terms.

19-Jewel Adjusted Waltham No. 846—14-k white gold filled; assorted patterns, $42.50 $1.25 down and $1.00 a week

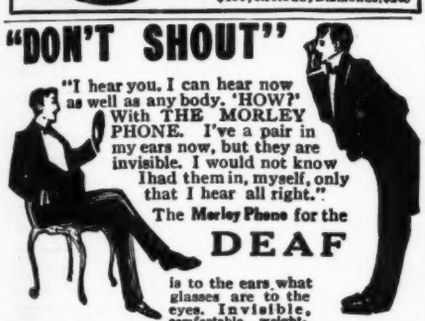
We carry all standard makes of Railroad Watches—guaranteed to pass inspection. Credit at Cash Prices.

Wrist Watch No. 18—14-k white gold. High grade 15-Jewel movement. $14.85. $1.45 down and ..... $1.40 a month

Wedding Rings
No. 824—The "Elite" $7.50 18-k white gold ....
Set with 3 Diamonds, $22.50; 5 Diamonds, $32.50; 7 Diamonds, $42.50; 9 Diamonds, $52.50; 12 Diamonds, $67.50. All platinum, $25. With 3 Diamonds, $50; 5 Diamonds, $70; 7 Diamonds, $80; 9 Diamonds, $100; circled by Diamonds, $200

Cushion Strap Watch, nickel, 6 Jewels—high grade leather strap. Special $9.95

"DON'T SHOUT"



"I hear you. I can hear now as well as any body. 'HOW?' With THE MORLEY PHONE. I've a pair in my ears now, but they are invisible. I would not know I had them in, myself, only that I hear all right."

The Morley Phone for the DEAF

is to the ears what glasses are to the eyes. Invisible, comfortable, weightless and harmless. Anyone can adjust it. Over one hundred thousand sold. Write for booklet and testimonials.

THE MORLEY CO., Dept. 797, 10 S. 18th Street, Philadelphia

ZIP-ZIP SHOOTER
CAMPERS AND TOURISTS:

Here is the very thing for you; campers tell us that this is the greatest weapon to be had where fire arms are prohibited. Zip-Zip Shooter is noiseless, powerful and effective and is used by a great number of tourists and campers. Thousands of boys are made happy with this wonderful Zip-Zip Shooter. If your dealer happens not to have them order from us. Zip-Zip Shooter 35c or three for $1.00. Send stamps, coin or money order.

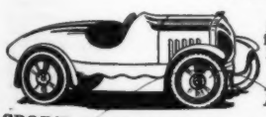
Automatic Rubber Co., Dept. B.B., Columbia, S.C.

100 SCALE PLANS OF OLD and MODERN SHIPS

Easy to build and sell ship models. Send 6 cents for catalog of over 100 plans, books, prints, maps and other things that smack of the sea.

SEA ARTS GUILD
405-N ELEVENTH AVE. MILWAUKEE, WIS.

Sport Bodies for Fords
at FACTORY PRICES!



This Model in Grey Prime $39.50
Write for Booklet A-10 Showing Other Models.

SPORT FACTORIES, Aurora, Illinois

Wireless Power

(Continued from page 114)

obtained of short wave and maximum power. The radio wave that furnished the wireless current supply was only two and four-tenths meters—about eight feet—long; yet through it he was able to "broadcast" thirty watts, about a twentieth of a horsepower. He can produce a wave of half that length, though his power is also cut in half.

To try out his scheme of reflecting a beam with a metal mirror, Dr. Thomas awaits the shorter-wave, higher-power beam he hopes to obtain. In his demonstration he allowed his radio waves to scatter at random through the surrounding air, and his feat of transmitting an appreciable amount of power was therefore the more remarkable.

DR THOMAS is not the first scientist to light lamps by radio; his simplified apparatus, rather than the demonstration of wireless light, is his greatest accomplishment. Nearly four years ago, Dr. Willis R. Whitney, of the General Electric Company, demonstrated before the American Association for the Advancement of Science at Cincinnati what he then characterized as an advance "as near to the wireless transmission of power as we have yet seen." Standing a foot away from a powerful electric coil through which alternating current was pulsing at high frequency he held up a lamp bulb like those in your home and caused it to glow by wireless power. This experiment follows the same principle as Dr. Rentschler's radio furnace, instead of Dr. Thomas' method of using radio waves at a distance.

More than twenty years before, Nikola Tesla first lit a lamp by radio. He used a wave of a size that required a huge receiving coil of wire attached to the lamp. The other end of the coil was grounded, and the length of the wire was so chosen as to be exactly "in tune" with the broadcasting station hundreds of feet away.

What Dr. Thomas has done is to substitute for complicated receivers an ordinary piece of straight wire, made possible by the short wave he has produced. To pick up power from any radio wave, the rod, Dr. Thomas found, must be exactly half as long as the wave itself. Collecting current from a broadcasting wave would therefore require a rod of unwieldy length. With Dr. Thomas' eight-foot wave, it need be only four feet long—a handy little rod to keep in your home!

THE way that Dr. Thomas' "half-wave receiver," as he calls it, picks up power from the air might be illustrated by placing a hollow tube half an "ocean wave length" long in the breakers at the seashore, pointing out to sea. One end of the tube would lie in the crest of an incoming wave, the other in the trough of the preceding one, and water would surge through it in one direction. A moment later, the crest would have reached the other end, the first end would be in a trough, and water would rush through it the other way. In the same manner an alternating surge of current runs back and forth along the metal rod from the radio waves in the air.

This much science already knows about the mechanics of generating and handling the radio power beam. But there will be more to learn—for the ray that Dr. Thomas seeks in his East Pittsburgh, Pa., laboratory, is a dangerous subject for experiment before scientists learn to control it. No one knows what might happen if such a beam were turned loose!

It might render the air through which it passed a conductor of electricity, much as does a bolt of lightning temporarily—and turn a shaft of air into an "electric wire" along which you could send an ordinary electric current. The radio beam, then, need not itself conduct the power, but (Continued on page 123)

A . . . LABORATORY . . . PRODUCT

With a Blade of LIGHT he slew the Greatest of all Demons~ DARKNESS

BURGESS BATTERY COMPANY
GENERAL SALES OFFICE: CHICAGO
Canadian Factories and Offices: Niagara Falls and Winnipeg

BURGESS FLASHLIGHTS & BATTERIES

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Money Making Opportunities
for Readers of Popular Science Monthly

Rates 30 Cents a Word. A 10% discount is allowed on all contracts for six consecutive insertions. Advertisements intended for the September, 1927, issue should be received by July 5th.

Advertising Services

ADVERTISE in 24 metropolitan dailies, 24 words, $15.00. Helpful Guide listing 1000 publications, 4c stamps. Wade Company, Baltimore Bldg., Chicago.

24 WORDS,-151 rural weeklies, $6.04. Ad-Meyer, 4112P Hartford, St. Louis, Mo.

ALL Advertisers should not be without the important facts on Money Making. Write today for the "Quick-Action Advertising Rate Folder" which contains information of value to you. If you are anxious for quick profit returns, do it now! Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

EFFECTIVE letters and advertisements for honest propositions. Edwin Brown, Box 85, Oak Park, Arizona.

Authors, Song Poem Writers, Manuscripts

SONG Poem Writers—Send for proposition. Ray Hibbeler, D10, 2104 N. Keystone Ave., Chicago.

FREE. "Song Writers' Guide." D22-1239 Elm. Green Bay, Wis.

SHORT stories, articles, etc., revised, typewritten, marketed. Hursh Service, Dept. 3, Box 1013, Harrisburg, Pa.

SONG POEM Writers. Monarch, 1472 Broadway, Dept. 126, New York.

I WANT song poems. Casper Nathan, J-3544 No. Racine, Chicago.

"MUSIC Composed" to words. Bauer Bros. (formerly of Sousa's Band), Oshkosh, Wis.

MANUSCRIPTS revised, typed. Quality work; low rates. Satisfaction guaranteed. Try us first. Bessinger Service, Galion, Ohio.

Automobiles and Accessories

DELIVERY bodies for Ford Model T. Chassis with inclosed cab, suitable for Contractors, Grocerymen and Farmers. Three styles. Price $49.50. Write Daniel Zimmerman, Craigville, Indiana.

SAVE 40–80%. New and Used Automotive Parts, 2000 models also truck parts, 5000 bargains. Bankrupt supplies, tires, generators, $10 up, carburetors $3.50 up. Complete Khaki roadster tops $10.00; khaki touring, fit most 5 pas., $15. Wheels, gears, radiators. Brightman Auto Parts Co., 321 Windsor Ave., Hartford, Conn.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

Aviation

THE American School of Aviation announces a new correspondence course in mechanics of aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 6741, 3601 Michigan Ave., Chicago, Illinois.

BIGGEST, Best Catalog Model Airplanes, Parts, Supplies; 5c postpaid. Ideal Company, 163½ Spring Street, New York.

LEARN to fly, courses from $100.00 to $200.00. New Standards OX5 Motor $900.00 to $1,200.00. Less Motor $700.00. Ready for delivery. OX5 Motors $100.00 up. Write for catalogue. Nicholas Beazley Airplane Co., Marshall, Mo.

SEND dime for 12 inch mounted propeller and circulars on free three foot model aeroplane. No selling. Aero Shop, 3050 Hurlbut Ave., Detroit, Mich.

AIRPLANES, Flying Boats, Aircraft Motors, and Supplies. 100 H.P. Gnome Rotary motor, new, $75, Florida. Leather helmets, $3.75. Nonsplinterable goggles: wide vision, $4.00; oval, $2.50. Logan Airplanes, 716 West Superior, Cleveland.

AEROPLANE motors. A few famous Gnome 9-cylinder 165 H.P. aeroplane engines costing Army $3,000.00, $35.00 each. Le Rhone 120 H.P., $50.00 each. Le Rhone 80 H.P., $50.00 each. Propellers. Aeroplanes $650.00 up. Resistal goggles, $2.00 pair. Send 10c for complete 12 page booklet. Marvin A. Northrop, 730 Washington Ave., No. Minneapolis, Minn.

IMPORTANT to advertisers! Are you deriving profit from your advertising? Write today for a copy of the "Quick-Action Advertising Rate Folder" showing "How You Can Use Popular Science Monthly Profitably." Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

Bending Machines

THE Famous Hossfeld "Wrenchless" Universal Iron Bender is the last word in bending machines. Bends both Pipe and Bars to most any conceivable shape. Bends Eyes, "U"s", Angles, Rings, Coils, etc. Accurately bends anything from a small nail up to a 1½" pipe cold. Instantly adjusted without a wrench. Thousands in use. Write for circular and prices. Hossfeld Mfg. Co., Winona, Minn.

IT PAYS TO ADVERTISE
in
"POPULAR SCIENCE"

The best evidence that it pays advertisers to use the classified columns of POPULAR SCIENCE MONTHLY is the fact that this magazine carries the second largest volume of classified advertising of any magazine in the world.

Read what Mr. M. E. Stephenson of the Stephenson Laboratory says about the results his advertising in Popular Science—

Gentlemen:

> It gives me great pleasure to tell you that my advertising in the classified columns of "Popular Science" has been a paying proposition. The number of years I have carried the advertisement in your classified columns without interruption testifies to that fact.
>
> It is the best magazine of its kind in the field and a four square proposition makes a combine that cannot help but be profitable, not only to the advertiser, but to the readers as well.
>
> Sincerely yours,
> **STEPHENSON LABORATORY,**
> **M. E. STEPHENSON**

It is paying 250 advertisers to use these columns—it will pay you. May we send you further information and closing dates? Address your inquiries to—

Manager, Classified Department,
POPULAR SCIENCE MONTHLY
250 Fourth Avenue, New York

Prize Winners
in the MAY Contest

FIRST PRIZE $10.00
F. A. Schliemann, Vallejo, Calif.
(Rhodes Mfg. Co.)

SECOND PRIZE $5.00
Leonard A. Phillips, Fairfield, Calif.
(Popular Science Monthly)

THIRD PRIZE $3.00
Isabel Bushinger, Monte Vista, Colo.
(La Salle Extension University)

PRIZE WINNERS who receive $1.00 each for their letters:

Edgar Leaverton, Columbus, Ohio
(New York Electrical School)

Herman A. Bolster, Rumford, Maine
(The Lee-See Company)

N. F. Whiting, St. Ignace, Mich.
(Bliss Electrical School)

Paul S. Bethscheider, West Point, Nebr.
(The Union Looms Works)

Mrs. W. H. Barr, Bartow, Fla.
(Palmer Institute of Authorship)

H. C. Tschanz, Salem, Oregon
(La Salle Extension University)

Charles R. Kuglin, Chicago, Ill.
(Theo. Audel Co.)

Blue Prints

TO THE man who has a Home Workshop and likes to work with tools. Popular Science Monthly offers the opportunity to purchase blue prints giving details of the construction of useful articles for the home. The following are a few of the blue prints available: No. 15, Workshop Bench, No. 17, Cedar and Mahogany Chest, No. 41, One-tube Radio Set, No. 42, Radio Receiver with three stages of amplification, No. 43, Four-tube Radio Receiver, 44 and 45, Model Pirate Ship, 46 and 47, Spanish Galleon, 48, Model Sailing Yacht, No. 50, Airplane model, 51, 52 and 53, Clipper Ship, 54 and 55, Five-tube Radio set. Send 25c for each blue print you wish to Popular Science Monthly, 242 Fourth Avenue, New York, N. Y.

Boats and Launches

HUBBELL Marine Coolers convert Ford engines into marine motors. Booklet free. Ford speedboat, easily built, blue print and directions, sixty cents. C. C. Hubbell, 14C Cottage St., East Norwalk, Conn.

BUILD your own boat. Outboard motor speedster, runabout, cruiser, row or sail using our knock-down materials. 55 Models. Send 25c for catalog. Brooks Boat Co., Inc., Salt Street, Saginaw W.S., Mich.

Business Opportunities

LEARN the collection business. Good income; quick results. Interesting booklet, "Skillful Collecting," free. National Collector's Association, Science Building, Newark, Ohio.

BECOME a Foot Correctionist. A New Profession not medical nor chiropody. All the trade you can attend to; many are making $3,000 to $10,000 yearly, easy terms for training by mail, no further capital needed or goods to buy, no agency or soliciting. Address Stephenson Laboratory, 10 Back Bay, Boston, Mass.

PATENTS procured; Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Bldg., Washington, D. C., or 41-Z Park Row, New York.

MINIATURE die-casting machines $50.00. Byrd—318 Reed, Erie, Pa.

ADVERTISE—In 275 country newspapers; 28 words, $10.00. Keator, Hartford Bldg., Chicago.

USED correspondence school courses sold on repurchase basis. Also rented and exchanged. Money-back guarantee. Catalog free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

INVENTIONS commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 183 Enright, St. Louis, Mo.

MIRRORS resilvered at home costs less. 5 cents per square foot; you charge 75 cents. Immense profits, plating auto parts, reflectors, tableware, stoves. Refinishing metalware, etc. Outfits furnished. Details FREE. Write Sprinkle, Plater, 94, Marion, Indiana.

15c PUTS your name on mailing list year. Receive offers, magazines, from wholesale supply houses everywhere. Kentucky Agency, Covington, Kentucky.

"SCHEMER," Alliance, Ohio, 36p monthly, prints Schemes, Tips, Formulas; subscriber reports $25,000 from three; another $10,000 from one. Try it! Year, $1.00; 3 months, 30c.

IF YOU are tired of working for others, and are looking for something to do during your spare time, write us. Service Box 531, Lake Forest, Illinois.

BIG business producer. A dollar bottle of our famous Vanilla and one dollar set of LaBohme Pearls both for One Dollar. You make 50c on every combination. Big flash, best quality goods, and everybody buys. Mystol Co., Dept. A5, Glens Falls, N. Y.

OPERATE Chewing Gum Machines. Large profits. Small Capital. Particulars free. Robbins Company, 23 Dodworth St., Brooklyn, N. Y.

OPERATE money-making mail-order business in spare time. Write for free particulars. Triangle Mail Order Service, 600 Blue Island Ave., R33, Chicago.

MAKE new delicious food specialty at home. Sells everywhere. Big profits. Formula and selling plan $1. Burand, Box 453, Tacoma, Wash.

SELL by Mail!—Books, Novelties, Bargain! Large Profits! Particulars FREE! C—Elfco, 525 South Dearborn, Chicago.

$50.00 WEEKLY mailing form letters. We furnish everything. Samples and particulars 10c. Whitney Co., Station C, Cincinnati, Ohio.

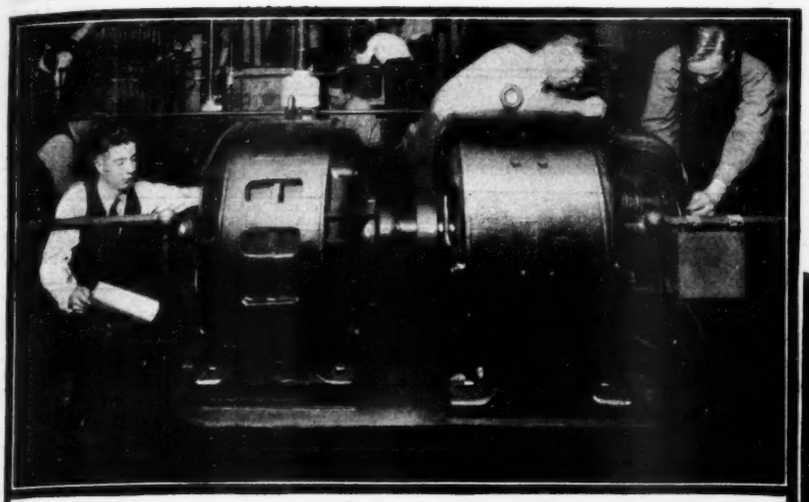
YOU Are Now Reading an Advertisement which may make you Thousands of Dollars if you'll send for my "Eye-opening" Literature and Lists of Guaranteed Formulas for making the World's Biggest-Selling Specialties in all lines, right in your own Home, Shop, Office, etc. Write today for this Free Money-Making Information. Dr. Liscomb Miller, Chemist, Tampa, Florida.

SIGNS and Showcards Easily painted with Letter Patterns. Large variety of Styles and Sizes. Samples for stamp. John Rahn, B2120 Neva Ave., Chicago.

BUSINESS Guide with free legal service sells everywhere. Wells cleared $1,185 in 35 days. Write for free outfit. Nichols Co., Naperville, Ill., Box 5.

WE START you in business, furnishing everything. Men and women, opportunity to earn $35 to $100 weekly operating Ragsdale's original "New System Specialty Candy Factories" anywhere; wholesale or retail. Big commercial candy book free. W. Hillyer Ragsdale, Drawer 19, East Orange, N. J.

MAKE Much Money—Making, Selling Your Own Goods. Formulas, Processes, Trade Secrets. All kinds. All lines. Catalog Free. C. Thaxly Co., Washington, D. C.



A Glimpse Into the Coyne Electrical School

Those who see the great roaring shops of Coyne for the first time are amazed. Here are students from every State in the Union working on the greatest outlay of electrical apparatus ever assembled in any school . . . costing hundreds of thousands of dollars . . . real dynamos, huge motors, actual skeleton houses, complete power plants, transmitting stations, switchboards of all kinds . . . everything from doorbells to farm power systems. Here, with this full-size machinery in full operation every day, Coyne students get years of experience in a few months. Here with two instructors to every 25 men, Coyne students learn by actually doing. Here—and nowhere else in the world—can you get such training!

The photograph above is one of 150 views in our catalog, a copy of which will be mailed free upon request. See coupon below.

LEARN ELECTRICITY
Without Books or Lessons
IN 12 WEEKS

By Actual Work—in the Great Shops of Coyne

SOME kinds of jobs ought to be labeled with a big sign that says "Man-killer." They are either so heavy, dirty and hard that they sap a man's strength and keep him dog-tired all the time—or else they are so disagreeable, uninteresting and poorly paid that they kill his ambition in almost no time. And AMBITION is the most valuable thing a man can have!

Fascinating Work—Real Pay!

That's why so many men are turning to ELECTRICITY, which offers unlimited rewards and opportunities—with ordinary salaries of $50—$75—$100—and $150 a week! Right now big electrical jobs are actually going begging! Electrical experts with 12 weeks of training are in demand—and the need is growing every day! The situation is one that spells O-P-P-O-R-T-U-N-I-T-Y in letters a foot high for the man who is wide-awake enough to see it!

Learn Quickly

Let me make you a master electrician—the Coyne way. I've done it for thousands of others—farmers, laborers, factory men, and hundreds who haven't had more than 8th grade education! I can do it for you—and start you off on the road to independence and big earnings in just 90 days!

No Books or Dry Lessons

The secret of Coyne-training is that it is ALL PRACTICAL work. No books—no dry lessons—no useless theory. In the great shops of COYNE you learn the "ins and outs" of Electricity by actual work on *real* electrical equipment—the finest outlay in the country! And best of all—experts work right with you every step of the way, showing you all the electrical secrets that are essential to your success!

$100 a Week Jobs

are common in electricity. Our free employment bureau puts you in touch with many openings to choose from. The following are only a few of the kind of positions you fit yourself for in the Great Shops of Coyne:

Farm Lighting Experts	$60 to $100 a Week
Armature Expert	$50 to $100 a Week
Power House Operator	$50 to $75 a Week
Auto Electrician	$60 to $100 a Week
Inventor, Unlimited Income	
Maintainance Engineer	$60 to $100 a Week
Service Station Owner	$200 a Week
Radio Expert, $75 to $150 a Week	
Contractor, $3,500 to $15,000 a Year	

FREE R. R. Fare When You Enroll

Right now I will allow your Railroad Fare from any point in the U. S. to Chicago—the world's Greatest Electrical center. Send coupon for details.

No Education or Experience Needed

With a personal, *practical* method like this, is it any wonder I say I can make any man into a master electrician in 12 happy weeks? You don't need a bit of previous experience or advanced education. Many of our most successful graduates are fellows who never went to high school and hated "book-learning." The Coyne method is *different!*

FREE If You Act Now

Make up your mind today to get into one of these real-pay electrical jobs. If you act *now*—I'll pay your railroad fare to Chicago and give you 2 special courses free! RADIO and AUTOMOTIVE ELECTRICITY! And besides that, I help many fellows to part time jobs where they can make most of their living expenses while learning! FREE employment service for life after graduation, too. We place dozens of men in wonderful jobs every week!

Send for FREE Book

Just give me a chance to tell you about the unlimited opportunity that awaits you. Let me send you this big book free, containing over 150 photographs and listing and telling you how you can qualify for the kind of jobs that pay $75-$200 a week. If you really want more money and a wonderful future, send for this book now! No obligation. Simply mail the coupon.

Mail This FREE BOOK Coupon To-day

COYNE ELECTRICAL SCHOOL
H. C. LEWIS, Pres., Dept. B7-73 1300-10 W. Harrison St., Chicago, Ill.

COYNE ELECTRICAL SCHOOL
H. C. Lewis, Pres., Dept. B7-73
1300-10 W. Harrison St., Chicago, Ill.

Dear Mr. Lewis:

I want the facts, so without obligation, send me your free illustrated catalog and details of your R. R. fare.

Name.....

Address.....

City..... *State*.....

Business Opportunities

CLEVER new money-making scheme you can operate anywhere by mail in spare time. A permanent income with the least expenditure of money, time and effort. Not a cheap affair but a high class legitimate office business paying $100 a week and up. Takes $10 to operate it. Particulars for addressed stamped envelope or $2 for complete instructions. Metropolitan News Bureau, Box 1038, Washington, D. C.

CASH in on your artistic ability. Your home, your office, your spare time, your gold mine. Not a correspondence course. Sample and particulars 10c. Sartco, 1014 Mulberry, Springfield, Ohio.

INCOME Increaser—Newly enlarged 36-page monthly magazine of best, latest ideas, plans, schemes, tips, pointers, starters. One year, $1.00. Three months, 25c. Income Increaser, 638 Court, Boston, Mass.

Capital Raising

CAPITAL Raising Campaigns Prepared. Commission Basis. Morris Advertising Agency, 3608 Warren St., Philadelphia.

Chalk Talks

LAUGH producing program, $1.00. Catalog free. Cartoonist Balda, Oshkosh, Wisconsin.

Chemists

OUR new catalog listing 5000 chemicals, 2500 illustrations, Laboratory apparatus and 1000 books. Sent on receipt of 50c. Radio catalog (100 pages) liberal discounts, 10c. Laboratory Materials Company, 641 East 71st Street, Chicago, U. S. A.

Dogs, Birds, Fish

BEAUTIFUL registered bull pups, $15. Bulldogs, 501 Rockwood, Dallas, Texas.

Education and Instruction

DON'T prepare for any Civil Service examination without seeing our free catalogue. Columbian Correspondence College, Washington, D. C.

HOME Study Courses. All Schools, Lowest Prices. Terms. Catalog Free. Mention subject. Fred Goetz, 440-B Sansome, San Francisco.

"1,001,001,001,001 BRIEF numerals." One dollar for the system with its interesting history, until Nov. 1927. Enclose self addressed stamped envelope for samples or reply. Address Hyrum Alpha Thomas, Box 69, Glenwood, Iowa.

CARTOONING and Commercial Art. 25 lessons, 300 Illustrations, 2 clothbound volumes and drawing outfit $5 postpaid. Catalog Free. Nu-Way Art School, 220 Graham Ave., Brooklyn, N. Y.

HOME Study Courses by all schools on all subjects, sold complete in fine condition, at bargain prices, because slightly used. Sensational reductions on all standard drafting, engineering, automobile, radio, chemistry, electrical courses. Money Back Guarantee. Easy Terms. Courses bought. Write for FREE catalog. Economy Educator Service (Dept. N), 202 W. 49th St., New York.

LEARN simplified bookkeeping and Pitman light-line shorthand, 50c; squaring circle interest problems. Will Marr, 605, Nashville, Tenn.

SWIFTHAND, the New Writing System, revolutionizes handwriting, combining shorthand speed with the accuracy and legibility of print. New principle eliminates guesswork despite speed. No abbreviations need be memorized. Scientifically based on the alphabet but even easier to learn. Uses only longhand strokes. Particulars FREE. Economy Educator Service (Dept. N), 202 W. 49th St., New York.

HOME study: High School, Normal, Business, and Collegiate courses. Bulletin free. Apply, Carnegie College, Rogers, Ohio.

LEARN Bookkeeping in Ten Lessons. Shelby course is brief, concise, complete. Makes bookkeeping easily understood. Price $5. Write for particulars. Shelby Publishing Co., 605 Cotton Exchange Bldg., Memphis, Tenn.

LaSALLE Traffic Course, 40 books, like new, sacrifice $20.00. LaSalle American Law and Procedure, 14 vols., $20.00. LaSalle Higher Accountancy, 5 new volumes, $10.00. These bargains will be quickly taken. Rush your order. We will ship on receipt of ⅓ down, balance C. O. D. Business Builders, Athens, N. Y.

"DOUBLE entry bookkeeping mastered in 60 hours with 8 keys; guaranteed; diploma." International Bookkeeping Institute, Desk 10, Springfield, Mo.

CARTOONING—Complete course. Unusually low price. Particulars on request. Carlson Cartoon Service, Dept. 8, 116 West 39th Street, New York.

Electrical

THE Electrician's Wiring Manual, By F. E. Sengstock, E. E. Contains all the information needed for the proper installation of lighting and power systems in houses and other buildings. It completely covers inside electrical wiring and construction in accordance with the National Electric Code. Pocket size—flexible binding. 448 pp. Price $2.50. Popular Science Monthly, 250 Fourth Ave., New York City.

Farm Wanted

WANTED—Hear from owner good farm for sale. Cash price, particulars. D. F. Bush, Minneapolis, Minn.

Financing and Investments

ASSURANCE—Trading in the Stock Market. How this is best obtained and how you can trade in 100 shares of stock for $150 to $225 is explained in our free Booklet. Paul Kaye, 149 Broadway, New York.

For Boys

INTERESTED in Science? Form Science Club in your town. Conduct experiments, field trips, etc. Instruction booklet, club plans, membership blanks, sample magazine, 25c coin. Scientific Clubs America, McComb, Mississippi.

For Inventors

UNPATENTED Ideas Can be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 805 Jenifer Building, Washington, D. C.

INVENTIONS Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 183 Enright, St. Louis, Mo.

INVENTORS: Get this pamphlet—"What to Invent." No theory or guess work, but things actually asked for by manufacturers. Sent prepaid for only $1.00. Inventors' Syndicate, 23 Paladium Bldg., St. Louis, Mo.

I AM in touch with hundreds of moneyed men and manufacturers who wish to buy good inventions. Hartley, 38 Court St., Bangor, Maine.

INVENTORS' Universal Educator—contains 900 mechanical movements; 50 perpetual motions. Tells how to obtain and sell patents. Suggests new ideas. Explains how to select your attorney and avoid patent sharks. Special Price, $1.00 postpaid. Albert E. Dieterich, 681 Ouray Bldg., Washington, D. C.

GET your own patents. Forms, complete instructions, $1. Cooperson, Campbell, Calif.

INVENTORS assisted financially to secure patents. Write for particulars. Equitable Investment Company, Box 1648, Washington, D. C.

For Men and Women

DETECTIVES—Work home or travel. Experience unnecessary. Particulars free. Write, George Wagner, 2190-P Broadway, N. Y.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

DETECTIVE'S Ring—Watch Others Unnoticed! Sterling silver with special mirror. Patented. "Like eyes in back of your head." Send $3.00 and strip of paper showing finger size. Guaranteed. Ren Mfg. Co., Desk 62, Winchester, Mass.

Formulas

BIG Profits! Manufacturing a "Famous New 4 in 1 Beauty Cream." Sell by agents or mail. Formula $1.00. Earl P. O., Box 235, Lorain, Ohio.

DON'T Buy Formulas till you've read my Valuable, "Eye-Opening" Literature for producing Guaranteed Money-Making Specialties in all lines. Mailed Free. Address Miller, Manufacturer's Chemist, Tampa, Florida.

MAKE Much Money—Making, Selling Your Own Goods. Formulas, Processes, Trade Secrets. All kinds. All lines. Catalog Free. C. Thaxly Co., Washington, D. C.

For Sale

FOR Sale: Patent for United States and foreign countries, Improved Flour Sifter; Outright or Royalty Basis. Harry Nakagawa, Tanana, Alaska.

For the Home

HOT water on tap, $6. Make your own Automatic. Write John Kirkeby, San Luis Obispo, Calif.

GRANDFATHER clock works $5.00. Build your own case, instructions free; make good profits selling your friends. Clock works with chimes for old or new cases. Write for full particulars. Clock Co., Nicetown, Penn.

TO THE man who likes to work with tools, Popular Science Monthly offers the opportunity to purchase blueprints giving details of the construction of useful articles for the home. The following are a few of the blueprints available: No. 1, Sewing Table, No. 5, Kitchen Cabinet, No. 13, Tea Wagon, No. 15, Workshop Bench, No. 17, Cedar and Mahogany Chest, No. 43, Four Tube Radio Receiver, 44 and 45, Model Pirate Ship, 46 and 47, Spanish Galleon, 48, Model Sailing Yacht. Send 25c for each blueprint that you wish to Popular Science Monthly, 242 Fourth Avenue, New York, N. Y.

CEDAR chests only $11.65—"Red-i-Kut" complete with rich copper trim—you assemble and save half—send for pictures. "Red-i-Kut" Kuempel, Guttenberg, Iowa.

Help Wanted

EARN $25 weekly, spare time, writing for newspapers, magazines. Experience unnecessary. Details free. Press Syndicate, 971, St. Louis, Mo.

STEAMSHIP positions—Europe. Orient. Good pay. Experience unnecessary. List of positions free. Box 122-Z. Mount Vernon, N. Y.

SILVERING Mirrors, French plate, easily learned; immense profits. Plans free. Wear Mirror Works, Excelsior Springs, Mo.

MEN wanting forest ranger job; $125-$200 month, nice cabin. Hunt, trap and patrol. Write for list National forests. Rayson, Dept. B-23, Denver, Colo.

MEN, get Forest Ranger job; $125-$200 mo. and home furnished; permanent; hunt, fish, trap. For details, write Norton, 224 McMann Bldg., Denver, Colo.

IF YOU Are A Man Worthy of the name and not afraid to work I'll bet you $50.00 you can't work for us thirty days and earn less than $200.00. Think I'm bluffing? Then answer this ad and show me up. Openings for managers. Wonder Box sells on sight. The best selling proposition in America today. Write Tom Walker, Dept. 111, Pittsburgh, Pa.

SECRET Service Badge, credentials and year's membership $2. Money back if not satisfied. Continental Secret Service System, Box 81K, Waukegan, Ill.

Help Wanted

MAKE fortunes as Real Estate Specialists. I made $100,000. Cooperate with me. Learn the secret of my success. Use my remarkable system. Start at home in spare time. Build wonderful business without capital or experience. Write at once for my amazing money-making offer. Address Ostrander, Room 34, 18 East 18 St., New York.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

MEN wanting Forest Ranger or U. S. Mail positions, $125-$225 monthly; steady, interesting work. Particulars free. Write Y. Bradford, 31 South 52nd St., Philadelphia, Pa.

HOW to obtain positions in South America, $1.00. Box 342, South Bend, Ind.

ARE you old at forty? See our advertisement on page 133 of this issue. The Electro Thermal Company, 4071 Main Street, Steubenville, Ohio.

Help Wanted Instruction

FIREMEN, Brakemen, Baggagemen (white or colored), sleeping car, train porters (colored), $150-$250 monthly. Experience unnecessary. 838 Railway Bureau, East St. Louis, Ill.

DETECTIVES Earn Big Money. Excellent opportunity. Travel. Fascinating work. Experience unnecessary. Write, George Wagner, 2190-P Broadway, N. Y.

U. S. GOVERNMENT jobs. Men—women, 18 up. $1140 to $3000 year. Steady, pleasant work. Paid vacation. Short hours. Experience unnecessary. Common education. List positions and sample coaching with full particulars—Free. Write today sure. Franklin Institute, Dept. L30, Rochester, N. Y.

Incorporations

DELAWARE Incorporator, Charters: Fees Small; forms. Chas. G. Guyer, 901 Orange St., Wilmington, Delaware.

Inlays

EXPERT inlays; send stamp for samples, literature. Robert Herrick; Newark, New York.

Insects Wanted

WHY Not spend Spring, Summer, Fall gathering butterflies, insects? I buy hundreds of kinds for collections. Some worth $1 to $7. Simple outdoor work with my instructions, illustrations, price-list. Send 10c for Illustrated Prospectus. Sinclair, Dealer in Insects, Dept. 7, Box 1424, San Diego, Calif.

Inventions Wanted

INVENTIONS commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 183 Enright, St. Louis, Mo.

WILL buy approved invention. Write W. L. Kendig, 416 N. Duke Street, Lancaster, Pa.

Laboratory and Chemical Services

YOUR chemical problem solved and working formula or process furnished for $5.00. Write me. W. Stedman Richards, Industrial Chemist, Box 2402, Boston, Mass.

EXPERIMENTERS. 20 C.P. Quality Chemicals for $1.00. Chem. Laboratories, 900 Belmont, Chicago.

Literary

THREE essays: "The Flowers of Democracy," "For 'Sports' Only," "The Powers That Be," and pamphlet: "Beyond Marriage." All for one dollar. John Velly, Box 294, South Bend, Indiana.

Machines

CONCRETE Building Block Machines and Molds. Catalog free. Concrete Manufacturing Co., 5 N. Main St. Louis, Mo.

Magic Tricks

MAGICS — Tricks — Puzzles. Catalogue Free. Schembri Company, Box 1124, Detroit, Michigan.

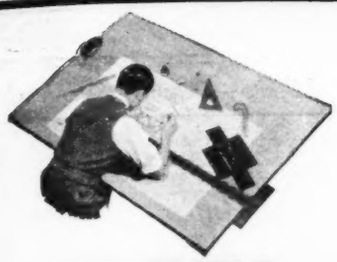
NEW 1927 "Fun-Magic-Mystery" now ready. 100 pages, profusely illustrated. Over 750 tricks—illusions—jokes—puzzles—books—European novelties at reduced prices. Postpaid, 10c. Lyle Douglas, Station A-4, Dallas, Texas.

Mailing Lists

99% GUARANTEED Mailing Lists. Agents, Business Firms, Individuals, Professions, for every need. Guaranteed reliable and accurately compiled. Catalogue and price list on request. National Mailing List Co., 845 Broad St., Newark, N. J.

Manufacturing

WIRE: Steel, Aluminum Copper and Brass. Wire goods manufactured to order. Cooley Manufacturing Co., 528 N. Western Ave., Chicago, Illinois.



GO INTO DRAFTING!

EXPERT Draftsmen are urgently needed in all building, manufacturing and engineering lines. Salaries of $60 to $125 a week are offered to men who can draw original plans, who can calculate and design machinery, buildings and products. A knowledge of Drafting is the entering wedge to success in the Electrical, Automotive, Structural, Architectural and all Mechanical industries. A good Draftsman is always sure of employment at a fine salary, and he's in line for promotion to still better, executive positions. Drafting is fascinating work, and you'll like the fine bunch of fellows and the good-natured atmosphere of the Drafting room.

First—We Train You

We have developed a simplified, one-step-at-a-time method for teaching Drafting. Any man with only common schooling can learn, quickly and easily, at home in spare time. We start you off doing actual Drafting room jobs, the way it's done in the big Architectural and Engineering offices. We give you the kind of training employers specify. In fact our instruction has been prepared by noted Engineers who are themselves big employers of Draftsmen. Mail coupon for 3 Drafting lessons, actually free, to prove that you can learn at home, in your spare time.

Then We Help You Get PLACED!

Coupon also brings amazing combination training and employment service offer, which says, unless this instruction leads directly to a better job and increased salary, it will not cost you a penny.

Outfit GIVEN!

We include without extra charge, as a part of this training, imported instruments, board, T-square, triangles, paper, ink and supplies. These are full size and professional quality—the kind you will keep and use in your job after you finish.

EVERY JUNE They Say "Go Back Half a Million Places, to the End of the Line!"

O. C. MILLER

You men who are earning *less than $40 a week*, who have neither school education nor specialized training—have you noticed how hard it's getting to find, or *keep*, a good job? Have you watched the spread of UNEMPLOYMENT, and do you know that it's *your class* which are first to be fired when the high pitch of prosperity lets down a bit? Do you realize that BIG CHANGES have taken place in all business and industry in the past five years, and that unless you learn to know and face these dangers, you're SUNK? The American School presents these facts in a friendly spirit, to help you realize how these NEW CONDITIONS strike at your very existence.

Each Year Worse "Luck"

Ten years ago men could "get by" with neither schooling nor training. Then it was still possible to learn by "practical experience" alone. Today, there are MILLIONS of high school and college graduates to compete with you for jobs and advancement. Each June *half a million more* come into the battle field armed with DIPLOMAS. They are elbowing uneducated, untrained men out of the way. They are pushing into the factories and offices and drafting rooms. *What chance have YOU to win against this "June" army of better educated men?*

There's One Way Out!

Now you see the danger which you must face sooner or later. What are you going to do about it? You can't quit your job and go away to school, but *the school can come to you.* You can get SPECIALIZED TRAINING, right in your own home, in spare time, the best sort of education for your needs, better for your purposes than general school subjects, the kind of equipment which employers are seeking these days of highly-organized industry. We have equipped 250,000 men to meet the new dangers, we have prepared them for better jobs and bigger pay. We have placed many in fine positions.

You have only to follow their example. You can afford the cost and the terms. And you take no risk. We take all the risk that you will succeed. You must master the training, you must be placed in a well-paid position, *or the service will not cost you a penny.*

LAST CALL!

What are you going to do about it? You must face the new dangers RIGHT NOW. You dare not put off decision. It will be much harder to meet the enemy WHEN HE IS UPON YOU. You won't find it as convenient *to start*, after you're out of a job, as today. Snap into it, then. Mail the coupon. Get all the facts about the new conditions in our booklet "The June Terror." Look into the opportunities open to you when you're an expert Draftsman. Find out how easily you can learn, at home. *Get our guarantee to train you and help you get placed.* DO IT NOW!

O. C. Miller, Director Extension Work

The American School

Dept. DB-75, Drexel Avenue and 58th Street, Chicago

3 DRAFTING Lessons FREE!

O. C. MILLER, Director Extension Work,
American School, Dept. DB-75,
Drexel Av. & 58th St., Chicago.

☐ Please send free booklet "The June Terror."
☐ Please send 3 Free Drafting lessons to prove I can learn at home, in spare time.

Name.....

Address.....

Age..... Occupation.....

Miscellaneous

FORMS to cast Lead Soldiers, Indians, Marines, Trappers, Animals, 151 kinds. Send 10c for Illustrated Catalogue. Henry C. Schiercke, 1034 72nd St., Brooklyn, N.Y.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

CASH Paid for dental gold, false teeth, discarded jewelry, diamonds, platinum. Mail to Robert Uhler, 425 Sterling St., Brooklyn, N. Y.

Models and Model Supplies

SHIP Model Fittings: Send stamp for list. A. J. Fisher, 1002 Etowah Ave., Royal Oak, Mich.

SPECIAL Machinery or parts, Dies, Tools, Metal Specialties, Model special gears, stock gears and Model Supplies. Send 5c for Catalogue. The Pierce Model Works, Tinley Park, Ill.

WORKING models built. Drawings prepared free. Let our designing and engineering departments and 27 years' experience assist you with your invention. Lowest prices. Hohmeier Mfg. Co., 1385 E.-17th St., Cleveland, Ohio.

WOODS for Models, Scroll Work and inlaying. Fred Wild, 510 East 11th St., New York.

SHIP Model Fittings and readycut hulls. Send dime for list. Roy Hancock, 323 Douglas, Portsmouth, Va.

AIRPLANE models, build and fly them. Our large catalogue illustrating 21 finest models, complete line of supplies sent postpaid for 10 cents. U. S. Model Aircraft Corp., 341-P-Monroe St., Brooklyn, N. Y.

SPECIAL machine builders, tool and die makers, inventor's models, production work of all kinds. Dept. J. Quality Hardware & Machine Co., Ravenswood and Thorndale Avenues, Chicago, Ill.

SHIP Models! Complete parts and blueprints for Three Masted Chinese Junk, 60c postpaid. Casson-Craft, Framingham, Mass.

MODEL steam engines and boilers. Boat and boiler fittings. Send 10c stamp for catalog. Refunded with first order. Model Machine Shop. 212 Price St., Rahway, New Jersey.

Motion Picture Business

MOVIE film 1c ft. 150 ft. $1. Reels $2.75 up. Stamp brings samples and list. X. Sales Company, Box A1506, New Haven, Conn.

Motorcycles

MOTORCYCLE bargains. Used, rebuilt. Guaranteed. Shipped on approval. Catalog free. Floyd Clymer, 812 Broadway, Denver, Colo.

INDIAN motorcycles $50. Standard models—$10 deposit with order, balance C. O. D. Stern Bros., 1790 1st Ave., N. Y. City.

Motors

MOTORS—New GE 110 or 220 volt 60 cycle Single Phase, ¼ HP $11.90, ½ HP $28.53, 1 HP $38.50. Mail $3 Check or Money Order. We will ship C.O.D. anywhere. Motor Specialties Co., Crafton, Penna.

Music and Musical Instruments

SAXOPHONISTS — Clarinetists — Cornetists — Trombonists—get "Free Pointers." Virtuoso Music School, 36, Buffalo, N. Y.

VIOLINS—Fine handmade. Low prices. J. Lehto, 935 14th, San Pedro, Cal.

Office Devices

ADDRESSING machines, multigraph, duplicators, folders, check writers, sealers, dictating machines, at about half new cost. Pruitt, 117 N. Market St., Chicago.

ALL ADVERTISERS should not be without the important facts on Money Making. Write today for the "Quick-Action Advertising Rate Folder" which contains information of value to you. If you are anxious for quick profit returns, do it now! Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

Patent Attorneys

PATENTS—Time counts in applying for patents. Don't risk delay in protecting your ideas. Send sketch or model for instructions or write for FREE book, "How to Obtain a Patent" and "Record of Invention" form. No charge for information on how to proceed. Communications strictly confidential. Prompt, careful, efficient service. Clarence A. O'Brien, Registered Patent Attorney, Security Bank Building (directly across street from Patent Office), Washington, D. C. (See page 125)

PATENTS. Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 724 9th Street, Washington, D. C.

INVENTORS' Guide free on request; gives valuable information and advice for all who have original ideas or improvements. Frank Lederman, Registered Attorney and Engineer, Woolworth Bldg., 1714, New York.

UNPATENTED Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 811 Jenifer Building, Washington, D. C.

MILLIONS spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free book—tells how to protect yourself, how to invent, ideas wanted! How we help you sell, etc. American Industries, Inc., 501 Victor Bldg., Washington, D. C.

Patent Attorneys

PATENTS, Trade-Marks, all countries. Ten years' experience examining applications in Patent Office. Consultation invited. George Beeler, Patent Attorney, 11 Park Place, New York.

MONROE E. MILLER, Ouray Bldg., Washington, D. C., Patent Lawyer, Mechanical, Electrical Expert. Booklet and Priority Record blank gratis.

PATENTS Procured: Trade Marks Registered.—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Bldg., Washington, D. C., or 41-Z Park Row, New York.

RICHARD E. BABCOCK, Patent Lawyer, Washington Loan & Trust Bldg., Washington, D. C. Booklet.

PATENT, trade-marks, copyrights. Reliable services by an experienced practitioner devoting personal attention to each case. Inquiries invited. References furnished. B. P. Fishburne, Patent Lawyer. 525-C McGill Building, Washington, D. C.

LANCASTER AND ALLWINE, 232 Ouray Building, Washington, D. C. "Originators of the Form Evidence of Conception." Before disclosing your invention to anyone send for blank form to be signed and witnessed. Form and patent information bulletin free.

CARL MILLER, Registered Patent Attorney. McGill Building, Washington, D. C. Write for Instructions.

EDWARD C. SASNETT, Formerly a Principal Examiner U. S. Patent Office, Attorney-at-Law. Strictly personal service. Correspondence invited. 516 McGill Building, Washington, D. C.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

IMPORTANT to advertisers! Are you deriving profit from your advertising? Write today for a copy of the "Quick-Action Advertising Rate Folder" showing "How You Can Use Popular Science Monthly PROFITABLY." Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

INVENTOR'S Advisor, valuable patent book, sent free. Lebiner, Three Parkrow, New York.

PATENTS. As one of the oldest patent firms in America we give inventors, at lowest consistent charge, a service noted for results, evidenced by many well-known Patents of extraordinary value. Book, Patent-Sense, free. Lacey & Lacey, 648 F. St., Wash., D. C. Estab. 1869.

Patents for Sale

INVENTORS: Use our special service for presenting your invention or patent to manufacturers. Adam Fisher Mfg. Co., 183-A Enright, St. Louis, Mo.

TO MANUFACTURERS—Sale or Royalty. Patent No. 1,607,933. Whitney Book Trolly, adjustable table. A. Whitney, Big Timber, Mont.

PATENTS listed for sale. Equitable Investment Company, Box 1648, Washington, D. C.

Photographs and Supplies

HAVE you a camera? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 117 Camera House, Boston, 17, Massachusetts.

MAKE money in Photography. Learn quickly at home. Spare or full time. New Plan. Nothing like it. Experience unnecessary. American School of Photography, Dept. 1743, 3601 Michigan Avenue, Chicago.

Photoplays Wanted

$$$1250 FOR a Photoplay Story by an unknown writer and sold through our Sales Dept. We revise, copyright and market. Located in the heart of Motion Picture Industry, we know the demand. Estab. 1917. Send Mss. for free criticism. Booklet on request. Universal Scenario Company, 214 Western & Santa Monica Bldg., Hollywood, Calif.

Pipe and Boiler Tubes

PIPE second hand, guaranteed suitable for all practical purposes with new threads and couplings, sixteen feet and over; cut to your requirements, also Boiler Tubes. New Fittings. Pfaff & Kendall, 100 Waydell St., Newark, N. J.

Printing and Engraving

BETTER Printing for Less Money. Write us about your printing needs, and you will save money. Ernest Fantus Company, 525 South Dearborn Street, Chicago.

SUPERIOR quality printing. Attractive samples free. Kay Press, 5406 Thurston, Rochester, N. Y.

LET us bid on your printing order. First class work. Lowest prices. Crane Printing Co., 1111 East 33rd, Kansas City, Mo.

ALL ADVERTISERS should not be without the important facts on Money Making. Write today for the "Quick-Action Advertising Rate Folder" which contains information of value to you. If you are anxious for quick profit returns, do it now! Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

250 LETTERHEADS, 250 Envelopes—Bond, $3.00. Arrow Press, Kankakee, Ill.

"NEARGRAVUREMBOSO" Type-embossed Stationery—different—exquisite—Samples. Solidays, Knox, Indiana.

THOUSAND Hammermill Bond letterheads four dollars; Multigraphing, two. Miscellaneous printing. Mayray, Monmouth, Illinois.

Rabbits

MAKE big profits with Chinchilla Rabbits, Real Money Makers. Write for facts. Conrad's, 860 Conrad's Ranch, Denver, Colo.

Real Estate—Orchards—Farm Lands

PECAN—Orange—Fig Groves "On the Gulf" Monthly payments. Guaranteed care. Big, quick returns. Suburban Orchards, Dept. "S," Biloxi, Miss.

LAND free if planted to bananas. Bananas bear a full crop the second year. $5.00 monthly will plant five acres which should pay $1,500 profit annually. Reliable Companies will cultivate and market your bananas for ⅓. Bananas ripen every day and you get your check every 90 days. For particulars address Jantha Plantation Co., Empire Building, Block 744, Pittsburgh, Pa.

Salesmen and Agents Wanted

AGENTS—Clever invention! Inkspoon makes every pen a fountain pen. Fast office seller, big profit, demand increasing everywhere. Exclusive territory offered. Sample free. H. Marui Company, Tribune Bldg., New York.

GET our free sample case, toilet articles, perfumes and specialties. Wonderfully profitable. La Derma Co., Dept. F., St. Louis, Missouri.

AGENTS, $60—$200 a week. Genuine gold letters for store windows easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 434-A. Y. Clark, Chicago.

BANKRUPT and Rummage Sales. Make $50.00 daily. We start you, furnishing everything. Distributors Dept. 34, 609 Division, Chicago.

$10 DAILY silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. F, Decatur, Illinois.

AGENTS—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

BIG money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 47, East Orange, New Jersey.

A BUSINESS of your own—Making Sparkling Glass Name and Number Plates, Checkerboards, Signs. Big Book and Sample free. E. Palmer, 513, Wooster, Ohio.

AGENTS—Make a dollar an hour. Sell Mendets, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Co., Dept. 467, Amsterdam, N. Y.

EARN $10 daily silvering mirrors, plating and refinishing metal ware, headlights, chandeliers, bedsteads. Outfits furnished. F. Decie Laboratories, 1133 Broadway, New York.

POLMET Polishing Cloth cleans all metal. Sells fast at 25c. Sample free. F. C. Gale, 15 Edinboro St., Boston.

ANY salesman can sell them! Merchants everywhere use punchboards. Someone sells them, why not you? Collect big commissions daily. Newest, largest elaborate catalog sent upon request. Lincoln Sales Co., 9 S. Clinton, Chicago, Dept. G.

AGENTS: Make $500.00 Monthly. Pay daily. No investment. Rhinestone initial buckles and novelties. Sell easy everywhere. Exclusive territory. Chaton Novelty Co., 606 Blue Island, Chicago.

DON'T sell for others. Employ agents yourself. Make your own products. Toilet articles, household specialties, etc. 500% profit. We furnish everything and show you how. Valuable booklet free. Write at once. National Scientific Laboratories, 1976 W. Broad, Richmond, Va.

AGENTS, both sexes, we manufacture and control new household article. Fast seller. Big profits. Exclusive territory. Write now, Connolly, 123 Liberty St., N. Y.

AGENTS, Salesmen, Crewmen—You'll have the Devil's own time finding a better seller than "Zippo." Splendid profit on snappy 50c "Go-Getter" repeat article that sells on a ten-second demonstration. Works while you watch it. Demonstrates value while others waste time making claims. New development. Greatest scientific triumph of the age. It's the berries. Write immediately for complete proposition. Karam-Smith Company, 907 Bozan Street, Fort Wayne, Indiana.

AMAZING Gas Saver. Every Auto. 1 free to introduce. Vapor moisture. Doubles Mileage. Critchlow, E-142, Wheaton, Ill.

$75 WEEKLY. Man or woman wanted with ambition and industry, to distribute Rawleigh's Household Products to steady users. Fine openings near you. We train and help you so you can make up to $100 a week or more. No experience necessary. Pleasant, profitable, dignified work. Write to-day. W. T. Rawleigh Co., Dept. NY9953, Freeport, Ill.

FREE: Large wholesale specialty catalog, showing best sellers from all parts of the world. Sporis Co., Leaueur Center, Minn.

NEW Camera. Regular black and white photos finished quickly inside camera. Make money selling cameras, taking photos or doing both. Crown Company, Dept. 485, Norwalk, Conn.

$50.00 WEEKLY easy, Applying Gold Initials on Automobiles. No experience needed, $1.45 profit every $1.50 job. Free samples. "Raico Monograms," 1041 Washington, Boston, Mass.

35% COMMISSION selling $1.50 boxes Monogram Stationery. New. Write. Wolfeprint, Lawndale, Philadelphia.

CALIFORNIA perfumed beads selling like hot cakes. Agents coining money. Big profits. Catalog free. Mission Factory, R2328 W. Pico, Los Angeles, Calif.

SIMPLEX Vaporizer. 25 to 60% increased mileage guaranteed. Retails $1. Thirty days free trial. Exclusive territory. American Fixture Co., 232 West Water, Milwaukee, Wis.

Salesmen and Agents Wanted

YOU are wanted to resilver mirrors at home. Immense profits plating autoparts, tableware, etc., write for information. Sprinkle, Plater, 96, Marion, Indiana.

$15.00 DAILY (in Advance) introducing latest guaranteed hosiery for men—women—children. Just write orders. We deliver and collect. Capital—experience unnecessary. Samples furnished. Milton Mathews, Road 1527, Cincinnati, Ohio.

NOTHING Sells Like Shoes. Every person a prospect. Take orders for Mason Shoes direct from factory. 85 stunning styles. Amazingly low prices. No experience needed. FREE outfit. Mason Shoe Mfg. Co., Dept. 14, Chippewa Falls, Wis.

MISTER Agent let me tell you how to make the World's Biggest-selling Specialties as, Sealatite, puncture-proofing liquid for tires; Solvit Hand Cleaner; Mendit, Fabric Patching Liquid; Cellu-lac Automobile Finish—all colors; Bugacide, Fly-killing Spray; Non-Thermic Ice Saving Cloth; Tufnit, for quadrupling life of Silk Hosiery; Ducopol Guaranteed Most Efficient Automobile Polish. Fifty other equally Big Money-Makers. Investment Small. Profits Great! Let me tell you how to get the profit you're entitled to. Miller, Industrial Chemist, Miller Chemical Building, Tampa, Florida.

AGENTS: Build a permanently profitable business on one easily sold item. Globe Re-Atomizers, a new, patented invention has an untouched, ten-million dollar market awaiting it. Act now and obtain exclusive representation. Send $1.00 for sample and complete information. References: Chamber of Commerce, R. G. Dun, National City Bank, Brotherhood Bank, Globe Sales & Distributing Co., 101A Spokane St., Seattle, Wash.

AGENTS Wanted. $2.00 an hour for special advertising work among local families. Exceptional opportunity; pay starts immediately. American Products Co., 9216 Monmouth, Cincinnati, Ohio.

GREAT neckwear line now free! Features finest quality neckwear at factory prices. Collect big commissions daily. Write for FREE tie offer and FREE outfit. Nawco Neckwear, desk 7-V, Covington, Ky.

AT LAST! Reasonable priced Auto Emblems for every Lodge. Sells for only $1.25. Write for attractive selling proposition and FREE sample case offer. North Central Distributors, Department 10, Ashland, Ohio.

A PAYING Position Open to representative of character. Take orders shoes-hosiery direct to wearer. Good income. Permanent. Write now. Tanners Shoe Mfg. Co., 7-95 C St., Boston, Mass.

AGENTS $17.50 daily. Bonus besides. Sell finest line hosiery. Seven months guarantee. New selling plan gets orders. Write quick. Silk hose free for your own use. Betterknit Textile Co., Silk, 232, Greenfield, Ohio.

SELL America's Quality Asko all brass Spark Plug; sample outfit free; openings for State and County distributors; excellent profits; product guaranteed. Write "Asko," Canton, Illinois.

AGENTS—Genuine Broadcloth Novelty Shirts for wear with or without coats—Great Summer Sellers—Write quick for territory and FREE Samples. Cincinnati Shirt Company, Lane 1607, Cincinnati, Ohio.

AGENTS $240 month. Bonus besides. New auto given. Introduce new guaranteed hosiery. 126 styles, colors. Finest silks. Credit given. Samples furnished. Wilknit Hosiery Co., Dept. 1632, Greenfield, Ohio.

AGENTS. We have a whirlwind seller. Get details. Webster, 608 Wrightwood, Chicago, Ill.

MAKE Much Money—Making, Selling Your Own Goods. Formulas, Processes, Trade Secrets. All kinds. All lines. Catalog Free. C. Thaxly Co., Washington, D. C.

SALESMEN—get exclusive selling rights of a scientific drugless health product needed in every home; unlimited possibilities! Write Radiumized Applicator Co., 1303w Fillmore, Buffalo, N. Y.

AGENTS make $3.00 an hour taking orders for our 40 fascinating Kitchen Specialties. No Competition. Write quick. General Products Co., Dept. 31-F, Newark, N. J.

MARVELOUS patented invention, seals 3,000 envelopes hourly! Sells on sight $4.50. Tremendous profits! Big repeat business. Exclusive territory. Consolidated, 3 Nottingham Bldg., Boston.

BRAND new solid brass household article. Greatest trouble saver on market for price. Keeps iron cord out of the way. Sells in every home. 100% profit. Send 50c for sample and proposition. R. L. David Co., San Jose, California.

SALESMEN 600% Profit—Agents, Salesmen—Get in on this. Huge public installment buying created big demand for this article. Sold to merchants and others doing credit business. Three $7 sales daily net you $562 monthly. You should more than double this with subagents. Five powerful selling methods. Article sold and backed by ironclad guarantee. Wire or write at once for valuable territory now open to hustlers. Business Builders, Dept. 10, Athens, N. Y.

AGENT: Be a thousand miles ahead of competition. Patented product housewives want. 100% profit. Commission in advance if wanted. Manager, Box 929, New Orleans, La.

TOOL salesman for complete line of automotive tools sold direct to mechanics and repair shops; exclusive territory; 30% commission. Automotive Tool Mfg. Co., Milwaukee, Wis.

SALESMEN—Get free outfit and make $90 a week taking orders for famous Taylor rain-proof, made-to-measure caps and knickers for men. Also eight other big profit-makers. Commission in advance. We deliver. Taylor Cap Manufacturers, Desk T-7, Cincinnati, Ohio.

ARE you old at forty? See our advertisement on page 133 of this issue. The Electro Thermal Company, 4071 Main Street, Steubenville, Ohio.

NO MORE punctures, use Emmett's Puncture Protector. Cheap, clean, permanent. Free Sample. Agents wanted. Emmett's Products, 1026 N. W. 7th Court, Miami, Fla.

A SENSATIONAL seller. "Kleanezy" the new mop with the steel plate. Housewives delighted. Eager buyers. Will send one prepaid on approval to convince you how easily you can make $20.00 daily. Kleanezy Mop Co., Dept. 7-L, Delphos, Ohio.

AGENTS—Make $100 weekly selling real Irish damask table linen; big profits; sells on sight. Supplied direct at manufacturer's price. Goods sent by mail. Send $5 for full size sample cloth 2x2½ yards and free book of samples. Amazing value. Brands Limited, Successors to James Lindsay & Co., Belfast, Ireland (Established 100 years).

WALKER made $165 first day selling Collection System to doctors and merchants. Retails $6.50. Collects $65.00, costs $1.50. Adjustment Assn., Mobile, Alabama

Amazing Gas-Saving Invention!

Now Installed by Over Two Million Car Owners

OVER two million motorists throughout the world have now installed the Stransky Vaporizer on all makes of cars, trucks, tractors—even on an aeroplane. Learn here from their own lips how this queer little device has increased gasoline mileage and power and ended carbon, spark-plug and other engine troubles caused by faulty gas feeding. Read what competent authorities say. Then accept the inventor's challenge to test the device on your car—AT HIS RISK!

A Daring Offer

The inventor will send the Stransky Vaporizer to anybody to test on any car. If it doesn't save gasoline and prove satisfactory in every way—the test is free. What is more, HE WILL PAY A CASH FORFEIT if the test is unsuccessful. If you are as pleased with the device as other car owners have been, he offers an easy way to own it FREE OF COST! He guarantees that it will not harm the engine in any way. Even though you read no further, isn't the above as bold an offer as you ever read before?

How The Invention Works

John A. Stransky, former candidate for Governor of South Dakota, and one of the best-known men in the Northwest, is the inventor of the Stransky Vaporizer and Decarbonizer. As evidence of its sound engineering principle, a well-known, high-priced car installed a somewhat similar gas vaporizer as standard equipment on a recent model.

Official tests have shown that most car owners waste 20 to 30 per cent of their gasoline by improper carburetion. Thousands testify that this device has saved them this much and more—in some cases up to 50 per cent. It is a simple, harmless piece of metal, not much larger than a dollar coin. A 12-year-old boy can install it. And it is automatic and self-regulating. You just install it and forget about it. Then check results before and after using—and believe the evidence of your own eyes.

FORD
57 Miles on a Gallon
J. T. Jackson, Mich., reports he drove a 1914 model Ford 57 miles on one gallon.

CHEVROLET
43 Miles on a Gallon
"We have tried them out. Chevrolet got 43 miles."—F. S. Carroll.

DODGE
40 Miles on a Gallon
"I made over 40 miles per gallon on my Dodge between Brownsville, Texas, and Tampico, Mexico."—T. L. Brown.

INTERNATIONAL TRUCKS
Saves 41 per Cent
"I find it better than you recommend it. On the International truck we use we are saving by positive test 41 per cent in gas and our engine uses less oil." George Bell.

This amazing device performs an additional service—a new, easy way to clean out already formed carbon deposits—the same way carbon is removed from the famous Diesel engine. Then, in addition, read what other car owners say it has done—increased power, lowered gasoline cost, ended "barks" and "spitting" caused by carbon and fouled spark-plugs. And you can prove the story on your car—at the inventor's risk.

Accept This Offer

This coupon below will bring you full details of the offer that lets you test this device at the inventor's risk—the test to be free and a cash forfeit paid by the inventor if you are not thoroughly delighted.

Here, also, is a wonderful opportunity to make a handsome income—just showing this device to car owners and letting it sell itself. Read on the right how other Stransky representatives are piling up big cash profits. Over 5000 men have become Stransky distributors. Last year they netted $300,000 in profits on this low-priced gas-saver. No experience required—we give you a written plan to follow that shows how to sell every car owner. If you want to make $75 to $150 a week, speak up now! The coupon below costs you only a 2c stamp.

The STRANSKY VAPORIZER
Saves Gasoline

J. A. STRANSKY MFG. CO.,
Dept. H-730 Pukwana, S. D.

Resources Over $500,000.00
Est. 10 (Ten) Years

FREE OFFER

Fill out your name and address below without obligation to buy anything. Address envelope to

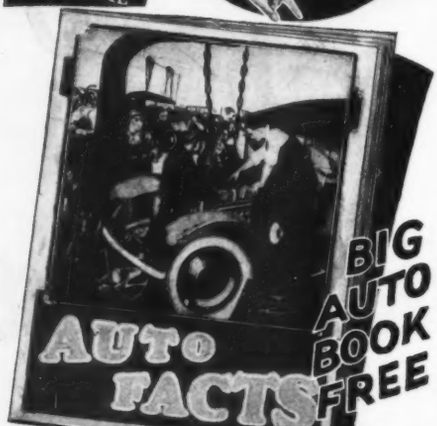
J. A. STRANSKY MFG. CO.,
Dept. H-730 Pukwana, South Dakota

Name.....

Address.....

City.....State.....

Be an ELECTRICAL AND MECHANICAL AUTO EXPERT



BIG AUTO BOOK FREE

Get into This—the World's

Biggest Business

IT NEEDS YOU! 6 Thousand Million Dollars paid *every year* for upkeep! Tremendous Opportunities for *Big Raises in Pay* QUICK for trained Men—*clip coupon now.* Common schooling all you need. I give you Lifetime Employment Service—Lifetime Consultation Service too!

I'll Train You AT HOME

Get my Free Book. Find out how you can become a Big Pay man *in amazingly quick time!* Keep your present job. Stay home. You don't have to leave your doorstep. Master every Branch of Auto Work *right in your own home.* See how I train you QUICKLY and EASILY to BOSS the Job, or GO INTO BUSINESS where Big Pay comes QUICK—and up to $10,000 a year can easily be made!

Make Money QUICK

Send for this amazing Free Book *right NOW!* See how hundreds of men are *boosting their salaries, making Big extra Spare-time money,* and getting into *Money-Making Businesses* of their own—NOT IN YEARS—but almost *right from the start*—in a FEW SHORT WEEKS OR MONTHS!

CLIP COUPON 4 BIG OUTFITS

Tools, Tool Bag, Portable Electrical Test Bench, 303 Wiring Diagram Charts, and Special Electrical Experimental Outfit — *all Free of Extra Charge.*

B. W. COOKE, Directing Engineer,
Chicago Motor Training Corporation
Dept. B-25, 1916 Sunnyside Ave., CHICAGO

MAIL THIS "JOB-WAY" COUPON

B. W. COOKE, Directing Engineer,
Chicago Motor Training Corporation, Dept. B-25
1916 Sunnyside Ave., Chicago, Ill.

Send me FREE Auto Book and proof that I can become an Auto Expert at home in spare time. Also send your 4 Outfits Offer. It is understood that this obligates me in no way.

.....Name

.....Address

.....Town.....State

Materials for Handy Men

Bearings, Belting, Blue Prints, Books on Mechanical and Scientific Subjects, Brass, Castings, Compressors, Gears, Lathes, Motors, Saws, Shafting, and Supplies of every kind for Model Makers and Handy Men.

Complete Catalogue 25 cents, which is allowed on first $2.00 order.

AMALGAMATED SALES AND SERVICE CORPORATION
327-D South LaSalle St., Chicago, Illinois, U.S.A.

Shop Equipment

BATTERY and Tire Shop Equipment and Supplies at wholesale. Send for our latest catalog. Adams-Barrs, Columbus, Ohio.

Stamps and Coins

STAMPS, 100. All different, 3 cents. Lists free. P. S. Quaker Stamp Co., Toledo, Ohio.

STAMPS Free—Ask for money-saving approvals. John K. Borresen, Cedar Falls, Iowa.

IMPORTANT to advertisers! Are you deriving profit from your advertising? Write today for a copy of the "Quick-Action Advertising Rate Folder" showing "How You Can Use Popular Science Monthly PROFITABLY." Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

STAMP Collectors—Phillips Monthly Bulletin (illustrated) offers over 2000 special bargains, sets, packets, etc. each issue. Free. Phillips, Box 1012, Hartford, Conn.

OLD coins, large Fall selling catalogue of coins for sale free. Catalogue quoting prices paid for coins, ten cents. William Hesslein, 101B Tremont Street, Boston, Mass.

CALIFORNIA gold $\frac{1}{4}$ size, 27c.; $\frac{1}{2}$ size, 53c. White cent and catalogue, 10c. Norman Schultz, Box 746, Salt Lake City, Utah.

150 GOOD mixed foreign stamps, 3c. Stanton (144), Niantic, Conn.

50 DIFFERENT Portugal Colonies, 10c; 200 different world, 10c. Louis Morrison, Glenolden, Pa.

20 VARIETIES unused free. Postage 2c. P. S. Miami Stamp Co., Toledo, O.

500 GOOD mixed stamps, bargain lists, magazine, catalog, packet hinges, all 25c. Approvals for beginners. Harvey Teeple, Decatur, Indiana.

50 DIFFERENT South American $.25; 100, $.50; 200, $1.50; 300, $3.00. Fred Onken, 630 79th Street, Brooklyn.

200–200–200. SEND for our 200 outfit containing 200 stamps; 200 hinges; approval sheets to hold 200 stamps; perforation gauge; millimeter scale and ruler; duplicate stamp container—all for only 15c to approval applicants. Edgewood Stamp Co., Dept. S., Milford, Conn.

MINT—$5 revenue free to applicants with references. Foreign revenues, telegraphs, locals, etc. Intriguing, educational, different, cheap. E. R. Vanderhoof, 1114 Logan Street, Denver, Colorado.

40 OLD coins all different $1; 25 different coins 50c. Lexington half-dollar unc $1; 1000 mixed Austria City bills $1. M. Denney, Box 315, Dallas, Texas.

Stories Wanted

STORY Ideas Wanted for photoplays, magazines. Big demand. Accepted any form for revision, development and submission to markets. Estab. 1917. Send manuscripts for free criticism. Booklet mailed on request. Universal Scenario Company, 402 Western & Santa Monica Bldg., Hollywood, Calif.

Technical Schools

CHICAGO Technical College offers short, intensely practical courses in Drafting and Engineering—civil, mechanical, electrical, structural—Architecture, Building Construction, Plan Reading, etc. Courses fitted to your needs. No time wasted. Instructors are experts. Graduates in demand at big salaries. Opportunities for part-time work while studying. Day and evening classes. 24th year. Enter any time. No special preliminary training required. Low tuition—easy terms. Write for 72 page illustrated Blue Book, describing opportunities open to our graduates. Chicago Technical College, 23 Chicago Tech. Building, Chicago.

Tobacco

LEAF Tobacco—Good, sweet. Chewing, 3 lbs., 75c; 5, $1.00; 10, $1.75. Smoking, 3 lbs., 50c; 5, 75c; 10, $1.25. United Farmers, Mayfield, Ky.

IMPORTANT to advertisers! Are you deriving profit from your advertising? Write today for a copy of the "Quick-Action Advertising Rate Folder" showing "How You Can Use Popular Science Monthly PROFITABLY." Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

Trade Schools

LEARN bricklaying and earn $1 to $1.75 an hour. Wm. M. Woods, who has trained 500 men will teach you bricklaying in our school run by 800 builders interested in giving jobs to Mr. Woods' students. Tuition $60.00 per month. Time required, 3 to 6 months. Board and room, $8.00 to $10.00. Work is actual bricklaying; you become a master in the craft, in line for highest wages and promotion. Ample space and material. Catalog free. Associated Building Employers, G-500 A. B. E. Building, Grand Rapids, Michigan.

Typewriters and Supplies

TYPEWRITERS: all makes; lowest prices; 5 year guarantee; send for illustrated catalogue. Henry Typewriter Co., 217 West 125 Street, New York, N. Y.

"RENT a typewriter." Any make. If you pay its price in rent, we give machine free. Catalog free. Pgh. Typewriter Supply, Suite 543, 339 Fifth Ave., Pittsburgh, Pa.

Wanted

DETECTIVES needed everywhere. Experience unnecessary. Particulars free. Write, American Detective System, 2190-P Broadway, N. Y.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

LEARN BY DOING

Every phase of all branches

ELECTRICITY

taught by

Actual Practice

In America's foremost and oldest institution for trade training

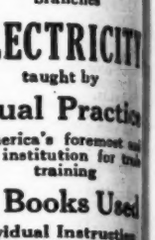
No Books Used

Individual Instruction Start Any Day

Write for FREE 64-page catalog

THE NEW YORK ELECTRICAL SCHOOL
40 West 17th St., New York City

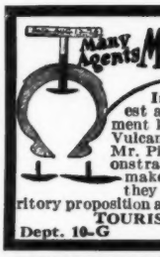
Learn How to Box



JIMMY DeFOREST Boxing Course
Has Developed Champions by Mail

In 20 weeks, under the System of Jimmy DeForest, World's Greatest Trainer and Maker of Champions, you will master the priceless knowledge that has made champions and started hundreds of boys on the road to Fame and Fortune. Every six months thirty are selected from all classes and recommended to leading promoters for boxing engagements. That's how pupils are brought to the front at once. Men who were once rank amateurs are today earning big money. The DeForest Course is also the greatest Physical Training System in the world. It has made weaklings strong, rebuilt men who were physically run down; develops energy, self-confidence and courage. Send today for the now famous book "The Genius of Boxing," greatest book of its kind ever written! full of valuable information, photos of great boxers and pupils who became champions over night. Enclose 10c to cover cost of mailing, etc. Write

JIMMY DeFOREST BOXING COURSE
347 Madison Ave., Box 2219, New York City



Many Agents Make $200.00 to $500.00 per month

New Patented Instant Plug Inserting Instrument. Best, Fastest and Quickest Plug Inserting Instrument known. That's why every Garage Vulcanizer and Tire Man is easily sold. Mr. Pim writes: "Sold 26 out of 30 demonstrations. Easiest seller and best proposition maker I've ever seen. Demonstrate and they buy. Write today for exclusive territory proposition and watch your bank account grow.

TOURISTS PRIDE MFG. CO.
Dept. 10-G Minneapolis, Minnesota

HAVE YOU AN INVENTION?

If so the WORLD PROGRESS will send you upon request sample copy Free containing *Suggestions to Inventors* as to Inventions Needed. We invite manufacturers to address us regarding inventions they want. Subscription for one year 60 cents.

WORLD PROGRESS PUB. CO., INC.
Room 202 Victor Bldg. Washington, D. C.

DRAW CARTOONS

Turn Your Talent Into Money

Cartoonists earn from $50 to $300 per week—some even more. Remarkable new Circle System of Drawing teaches you in half the usual time. Send for booklet and sample lesson plate explaining full details of the Course.

THE NATIONAL SCHOOL OF CARTOONING
615 Penton Building Cleveland, Ohio.

AGENTS 500% PROFIT

GENUINE GOLD LEAF LETTERS

Guaranteed to never tarnish. Anyone can put them on stores and office windows. Enormous demand, large profits, Paul Cline says: smallest day $28.70. R. L. Reed made $920 in two months. Write today for free sample and liberal offer to general agents.

METALLIC LETTER CO., 433A N. Clark Street, Chicago

BIG PROFITS in a NEW BUSINESS of your own —No Competition!

Send for the little book of Big Opportunities—"The Nestler Plan." It tells, in few words and with actual photographs, how any ambitious man can become a Nestler Operator, and build up a flourishing, money-making business of his own. There is a big demand for Nestler service from automobile owners everywhere. The Nestler Rubber Fusing Process is the first and only satisfactory method of servicing tires. You convert an old, worn tire into one as good as new at one-half the cost. Little capital required; previous tire or garage experience unnecessary; exclusive territory; full-time or spare-time, as you prefer.

Send TODAY for free book, "The Nestler Plan"

This book describes the amazing Nestler Method. Shows how to build up profits in your own exclusive Nestler business.

NESTLER RUBBER FUSING CO. INC.
Dept. 47 245 West 55th St., New York, N.Y.

Don't Envy The Plumber BE ONE!

$11.00-$16.00 PER DAY and work EVERY day, is the Plumber's wage.

Every skilled workman will tell you that Plumbers have the best of it. WINTER and SUMMER the Plumber is busy at top wages. No skilled Plumber is ever out of a job—compare his opportunities with any trade, plus the opportunities of having your own shop.

We teach you Plumbing with TOOLS (not books) under Licensed Master PLUMBERS in one of the finest equipped schools in America. We make you a Plumber, every branch is taught thoroughly—Lead Work—Blue Print for plan reading—all other tricks.

LEARN IN 8 to 12 WEEKS without previous experience.

If you are making less than $60.00 a week you owe it to yourself to investigate. Get FREE catalog that tells in pictures and words how we teach this trade. Special rates now.

UNIVERSAL PLUMBING SCHOOL
2031 Troost Ave. KANSAS CITY, MO.

If You Are A MAN

worthy of the name and not afraid to work, I'll bet you $50 that you can't work for us 30 days and earn less than $200. Think I'm bluffing? Then answer this ad and show me up. Openings for Managers. The "Wonder Box" sells on sight.

TOM WALKER
DEPT. 33 · PITTSBURGH, PA.

Electrical Engineering Course for men of ambition and limited time. Over 5000 men trained. Condensed course in Theoretical and Practical Electrical Engineering including the closely related subjects of Mathematics and Mechanical Drawing. Students construct motors, install wiring, test electrical machinery. Course designed to be completed in *one college year.*

BLISS ELECTRICAL SCHOOL
Prepare for your profession in the most interesting city in the world. Catalog on request.
107 Takoma Ave., Washington, D.C.

Skin Troubles

Cleared Up—often in 24 hours. To prove you can be rid of pimples, blackheads, acne, eruptions on the face or body, barbers' itch, eczema, enlarged pores, oily or shiny skin, simply send me your name and address today—no cost—no obligation. CLEAR-TONE tried and tested in over 100,000 cases—used like toilet water—is simply magical in prompt results. You can repay the favor by telling your friends; if not, the loss is mine. WRITE TODAY.

E. S. GIVENS, 458 Chemical Bldg., Kansas City, Mo.

Learn Photography at HOME

Many earn $3,000 to $10,000 a year. Prepare quickly during spare time. Also earn while you learn. New easy method. Nothing else like it. Send at once for free book, "Opportunities in Modern Photography" and full particulars. Special offer upon now.

AMERICAN SCHOOL OF PHOTOGRAPHY
Dept. 336-B, 3601 Michigan Ave., Chicago, U. S. A.

Wireless Power

(*Continued from page 116*)

serve simply as a channel for electricity. For instance, an isolated mining camp in the face of an inaccessible mountain might receive electric power to run the mining machinery from a beam shot through the air from the base of the mountain.

One thing, Dr. Thomas says, is certain—with half the power of a modern broadcasting station behind it, a short-wave radio ray focused in a narrow beam of concentrated power would kill anyone who stepped in its way. Stray electric currents which it would induce in a man's body would instantly burn him up. Here, then, is a veritable "death ray"—not a fantastic dream, Dr. Thomas points out, but like radio power a sober scientific possibility. In time of war, this ray would prove a terrible and awe-inspiring weapon. Radio rays of overwhelming power turned upon an enemy army would cause it to disappear in smoke. Along the radio beam might course powerful electric currents to complete the destruction.

BUT in its peacetime uses it would be of greatest service to man. High towers could be used to keep the deadly beam where it could do no harm as it transmitted vast quantities of power across the earth. At night a bluish glow would surround the transmitting tower from leakage of the high-tension current, and perhaps even the beam would glow like a searchlight piercing faint mist.

Smaller beams, less dangerous to man, might distribute the power at the receiving station. This would correspond roughly to the present system of using transformers to change the dangerous high-tension electric current used in wired power transmission into low pressure current safe for home use.

Into your home, perhaps straight through the wall, the ray would enter, while the "half-wave receiver" would absorb power to light your lamps—not ordinary lamps, but a special type of electric light built like a radio vacuum tube—and run your washing machine and electric toaster.

Can it be done? The "ifs" are merely matters of figures now. Scientists have taken away the mystery that cloaks radio power, and have shown how it is to be attained. Each by his own method, they are drawing nearer and nearer to its useful realization. With all the resources of great laboratories at their command, they are working out the last practical details. Any day, now, they may announce to a waiting world that at last the goal has been achieved.

Science Gives Shaving Hints

THERE'S a good reason why many men lose their temper more easily when they shave. The nerves on the side of the face are linked closely to the anger centers of the brain, and disturbing them causes trouble. This is one fact brought out in a recent scientific study of shaving. Here are others:

In stropping your razor, use a rigid strop, or, if you prefer a supple one, use a slow stroke. If the strop is too supple, or stroke too rapid, a tiny following wave in the leather or other material curls up after the blade and dulls it.

Don't let the blade get heated. Soft steel, such as that in safety blades, heats quickly, so in stropping them use a very slow and rather short stroke. Don't dip your razor in boiling water just before shaving, for this softens the steel.

Washing the face with toilet water before soaping makes the beard soft and insures an easier shave.

See the World FREE!

Taste Romance and Adventure In the Far Lands of the Earth

How often you've longed to see for yourself the awe of Egypt's pyramids—the beauties of the gorgeous Mediterranean sunset—the squalor of China's ancient cities!

Spend a few years, or the rest of your life, tasting high adventure on the seven seas and in all the world's great ports—roving the earth's highways and byways! You can do it FREE—all your expenses paid—and earn a good salary besides!

Only one profession will carry you around the world at will, traveling like a gentleman, but that's the most interesting and pleasant work there is—Radio Operating! Easily and quickly learned, there's no other profession like it for the man who wants the experiences and pleasures of world-travel. Radio operators are needed—all sea-going ships like the one shown here must carry from one to half a dozen or more.

Take a Look Beyond the Skyline Without a Penny's Expense

Radio operators aboard ocean liners live luxuriously—they rank as officers of the ship. Meals, a private cabin, all other living needs are furnished free, and besides the operator draws a good salary. You can learn quickly and easily at home in your spare time to be a Radio operator through our practical training methods. Take a look at the FREE BOOK which tells how—mail coupon below.

This U. S. Government-recognized school has been training successful operators since 1914. Our graduates are all over the world. We maintain an Employment Department to put you on your own ship. The world-famous NATROMETER, our own patented invention, obtainable only by students of this Institute, is recognized as the best and easiest way to learn the Radio code. A few short months, with the aid of the famous Natrometer and our quick home training, and you too can be a fully qualified Radio operator, sitting in your cabin like the one shown above, bound out for Liverpool or Nagasaki!

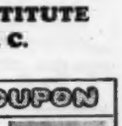
Read the Free Book that tells all about this fascinating profession and our practical Government-recognized methods of training you for it. Send coupon TODAY—no obligation. Special tuition offer now on, includes world-famous Natrometer free of extra cost with your course! Act at once.

NATIONAL RADIO INSTITUTE
WASHINGTON, D. C.

SPECIAL OFFER COUPON

National Radio Institute,
Dept. G-87, Washington, D. C.

Gentlemen: Without obligating me in any way send me your free book and information about your offer of Natrometer with course.



World-Famous Natrometer

Name.....

Address.....

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7635-E, Scranton, Penna.

Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the course *before* which I have marked X:

BUSINESS TRAINING COURSES

☐ Business Management	☐ Salesmanship
☐ Industrial Management	☐ Advertising
☐ Personnel Organization	☐ Better Letters
☐ Traffic Management	☐ Show Card Lettering
☐ Business Law	☐ Stenography and Typing
☐ Banking and Banking Law	☐ English
☐ Accountancy (including C.P.A.)	☐ Civil Service
☐ Nicholson Cost Accounting	☐ Railway Mail Clerk
☐ Bookkeeping	☐ Common School Subjects
☐ Private Secretary	☐ High School Subjects
☐ Spanish	☐ Illustrating
☐ French	☐ Cartooning

TECHNICAL AND INDUSTRIAL COURSES

☐ Electrical Engineering	☐ Architect
☐ Electric Lighting	☐ Architects' Blueprints
☐ Mechanical Engineer	☐ Contractor and Builder
☐ Mechanical Draftsman	☐ Architectural Draftsman
☐ Machine Shop Practice	☐ Concrete Builder
☐ Railroad Positions	☐ Structural Engineer
☐ Gas Engine Operating	☐ Chemistry ☐ Pharmacy
☐ Civil Engineer	☐ Automobile Work
☐ Surveying and Mapping	☐ Airplane Engines
☐ Metallurgy ☐ Mining	☐ Agriculture and Poultry
☐ Steam Engineering ☐ Radio	☐ Mathematics

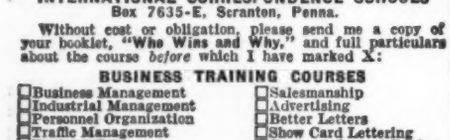
Name.....

Street Address.....

City..... State.....

Occupation.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian Limited, Montreal

CHICAGO

TECHNICAL COLLEGE

24th Year

Engineering
Architecture
Electricity
Drafting

Intensely practical training. 2 year Diploma; 3 year B.S. Degree; special 3 and 4 months' short courses. Courses adapted to your needs. No time wasted. Expert instructors. Graduates in constant demand. Opportunities for self-support while studying. Day and evening classes. Athletics. Enter any time. Low tuition—easy terms. Write today for your copy of 84-page illustrated "Blue Book," mailed free.

Dept. H-80
118 East 26th St. Chicago Technical College
Chicago

Chief of Battalion

(Continued from page 16)

McSweeney already had the receiver off its hook at the listening phone. His flat fingers pushed open the switch of the telegraph key at the right of the board and tapped it twice. Hennessey was running from the rear of the room. Jim Burton jogged at his heels. "I'd of give you five more moves!" he was crying.

"You ain't no checker player!" Hennessey answered him. "Hush, will you? Listen for location!"

McSweeney at the telephone repeated the crisp words of the operator at fire alarm headquarters.

"Corner of Hayden and Standard street. Standard and Hayden."

"Let's go!" Kellogg shouted, and clawed up to his place on the right side of the driver's seat.

DRIVER CARLSON, there ahead of him, sagged down like a sack behind the steering gear, while his wife waved goodbye from the driveway. Burton and Hennessey, still arguing, thrust their arms into rubber coats they snatched from the brass hose pipes on the tailboard. McSweeney, who had paused to bite off a chunk of tobacco, ran, as the great motor pumper jerked forward, and hopped to the rear step. Pipeman Stein still clung to the hose box.

It was one minute past nine by the clock. Engine 26 racketed into the street, its bell chattering, motor grumbling. Men and boys halted in their Sunday night strolls to watch the brief, glamorous passage of crimson steel.

"Hayden and Standard," Captain Kellogg shouted to his driver. "Better take the Ward street bridge. Truck 12 will be going that way; break an opening for us if there's a crowd." Five seconds later he muttered: "That's only half a block from Schwart's beef house, come to think." He yanked the bell rope savagely, as if a new, hot fury had laid hold on him.

Driver Carlson braced his feet and elbows, slowed the swaying engine, swung a corner with casual grace, and at once accelerated speed.

"Open her up full," the captain counseled. "Straightaway now. I'll watch the bridge . . . she's down all right. Tender's got his lantern out, giving us the highball. Open her up full—that's good!"

THE engine plunged out of the tawdry lights of the stockyards business district into a region of vast darkness. Occasional blank building fronts lifted sheer from the sidewalks. The rancid odor of the stockyards was sharper here and mingled with the oily smell of the industrial river and the acrid breath of railroad yards.

The ruby tail lamp of Truck 12 careened close ahead now. The lumbering length of the ladders made for slower progress than the compact power of Engine 26. It drew to the right of the road at a corner where a dim electric light broke the sulky obscurity.

By the glare of his own headlights, Captain Kellogg saw the commander of Truck 12 in the middle of the roadway, booted feet apart, listening, while a police patrolman waved his night stick. The pumper grumbled to a halt. A sharp gust of wind swept up the river and struck Kellogg's sweaty face.

"Where's it at?" he shouted, tumbling down from the seat.

"Don't know," the captain of Truck 12 answered. "Smoke—all over the place. Officer smelt it, telephoned alarm." He ran back toward his truck.

Kellogg sniffed. "That's not coal," he told himself. "Not railroad yards." Aloud he shouted: "Smells like lard."

His crew had slid down from the pumper. Axes in hand, they explored the dark with reckless feet. A trio of laddermen from the truck appeared out of the gloom ahead.

"Down that way!" the first of them panted. "Smoke's lots thicker."

Captain Kellogg's ax smashed the gate in a high wooden wall topped by strands of barbed wire. A cinder road lay straight to Schwart's beef house. Far to the left cattle were complaining in their pens. To the rear, across distant roofs, shrilled the siren of Flying Squadron Number 5, arriving thirty seconds late.

The smoke lay in black swaths on the warm moist cinders of the roadway, like heaps of dirty wool. Winds from the river stirred it. Kellogg jammed the claw of his wrecking iron under the main south door of the beef house.

"Give a hand here!" he cried.

Men strained, and the big door broke open. Dead, frosty air pushed out, chill with the bite of ammonia and the sharp tang of smoke.

"HERE 't is!" Kellogg shouted. "Lay a line, men. Eight section, round to the north end. Couple to corner plug, lay eight section, half-inch tip, hard suction. Get that, Carlson? Hard suction!"

He backed out rapidly. Stinging smoke crowded after him. He slammed the door. That blasted wind from the river, pushing all the fire and heat this way! He knew it would. Hadn't he told Dargan so? Hadn't he said so in his examination?

"Keep this door shut!" he commanded.

Ax in hand, he plunged around to the rear. There was one fence intervening. He ripped a hole through it with his ax, ready for hose. Midway across the north end of the brick wall, Kellogg found the rear door. He rattled the latch. He lifted his ax, then put it down deliberately.

"Where's that line?" he demanded of the dark. "Engine 26!" he bellowed. "Are you dead or something? This way—here! Got to wait all night?"

Hennessey ran first, as a senior pipeman should, his arms wrapped about the great brass nozzle. New white hose flapped at his rubber boot heels. Behind him, struggling with the stiff fabric folds, Burton was panting already.

"Truck 12 captain pulled a box alarm," he called to his officer.

Kellogg guided Hennessey to the door.

"He did, eh? That brings Dargan."

McSweeney charged around the corner of the building. Afar off Stein cried: "Ready, 26?"

"All set!" McSweeney answered.

"Water!" Captain Kellogg demanded.

HE LIFTED his ax, and waited while air hissed through the tip of the nozzle. He'd start no drafts till he had a good stream ready. A flutter of spray splashed against the wall. The ax bit into the timbers above the lock. The door withstood the first blow and the second. It opened at the third. Once more the breath of ammonia, of smoke and dead air. The smell of curing beef. The chill of artificial refrigeration.

The wind whined up the river at Kellogg's back.

"In and at it!" he commanded. "Find it, men!"

He had inspected the beef house often enough in preparation for this emergency. He knew each of its intricate passages on each of its seven cold dark floors. This rear outside door, through which he just had come, opened merely into a narrow brick-paved entry, with low ceiling and heavy, exposed, whitewashed beams. At its opposite end another thick door gave upon a long, cold corridor.

This corridor extended south to the front of the building. There it opened by a similar series of doors upon the front yards. The corridor was about a *(Continued on page 18)*

Chief of Battalion

(*Continued from page 124*)

hundred and forty feet long. Usually, in spite of warnings from the fire department, it was cluttered with hand trucks, left by laborers at the end of the day. Two thirds of the way toward the front, and on the right, opened the broad shaft of the beef elevator. It was a great gaping crater, capable of immense drafts, extending upward seven tall stories to the flimsy penthouse on the flat roof. Beyond the shaft, and on the right, a narrow iron door, always kept tightly closed, gave upon the cooling plant, with its condensers coated with frost.

The second door that he was hunting now was no more than ten feet inside the entry, if Kellogg remembered rightly. It was a heavy barrier of varnished oak, about eight inches thick, insulated with cork lining. The latch had a long iron handle like the lock on a butcher's cooler. He felt forward with the toes of his boots. He'd find that second door, drag his hose through it into the corridor.

FAR across the river he heard the clamor of engines responding to the box alarm. Out in the yard the captain of Truck 12 was shouting, collecting his scattered crew The flying squadron commander cried: "Helmets, Squad 5, smoke helmets! Have 'em ready!"

So Dargan was coming! Kellogg, hands stretched out ahead of him, discovered the second door. Let Dargan come! Let him stick his face in the south entrance! Wind was from the river. Wind was always from the river. Pushing smoke and fire through to the other end. Into the crew's face if they attacked from the south. Only Dargan said not. He'd been a captain twenty-six years; maybe he was right. Maybe there was some other reason for going in from the south. Kellogg hesitated a second. Then he pulled upon the long iron latch. He knew he was right! He'd enter from the north.

"Stand aside there, I'm opening!" he warned Hennessey.

He threw his weight against the handle. The door into the long corridor opened six inches. Heat puffed out. Heat saturated with fumes of ammonia and the nauseous odor of burning beef.

Firelight shone dimly, hooded in yellow smoke. Burning rafters crackled. Deeper in the basement sounded the destructive murmur of big flame.

"Water!" Kellogg ordered. He slid to the left six inches, head ducked, right foot braced to prevent an outward explosion of the partially opened door. "Give her water anywhere!"

HE GRIPPED the cold brass of the nozzle. Hennessey and McSweeney crowded close behind. Stein, coughing, was crawling forward along the line. Burton halted in the outer door according to orders.

"She's goin' good," McSweeney cried, "all the way through."

Burton ran into the entry.

"Dargan's here, sir!" he cried. "Says you're in wrong; says come out. . . ."

"Out?" Captain Kellogg turned the tip of the nozzle slightly to the right.

"Up a bit!" he directed. "Hit her a mite higher. Wash along the ceiling. . . ."

Acting Chief Dargan stormed through the outside door.

"Kellogg?" he screamed. "Kellogg, you in this way? Out with you! Are you a babe in arms, I ask you? Out! First company in and you take back door? Out with you! Do it right! Other end to. Get in front—front, I say—where you can see it comin'!"

The commander of Engine 26 whirled around and looked Dargan in the face. He heard McSweeney growl beside him, heard Hennessey swear. He hesitated (*Continued on page 126*)

PATENTS INVENTORS

Write for these FREE BOOKS!

At the left is a view of my drafting and specification offices where a large staff of experienced experts is in my constant employ. All drawings and specifications are prepared under my personal supervision.

Protect Your Ideas

Take the First Step Today

If you have a useful, practical, novel idea for any new article or for an improvement on an old one, you should communicate with a competent Registered Patent Attorney AT ONCE. Every year thousands of applications for patents are filed in the U. S. Patent Office. Frequently two or more applications are made for the same or substantially the same idea (even though the inventors may live in different sections of the country and be entirely unknown to one another). In such a case, the burden of proof rests upon the last application filed. Delays of even a few days in filing the application sometimes mean the loss of a patent. So lose no time. Get in touch with me at once by mailing the coupon below.

Strict Secrecy Preserved—Write Me in Confidence

All communications, sketches, drawings, etc., are held in strictest confidence in strong, steel, fireproof files, which are accessible only to authorized members of my staff. Feel free to write me fully and frankly. Your case will have my personal attention. It is probable that I can help you. Highest references. But FIRST—clip the coupon and get my free book. Do THAT right now.

Prompt—Careful Efficient Service

This large, experienced organization devotes its entire time and attention to patent and trademark cases. Our offices are directly across the street from the U. S. Patent Office. We understand the technicalities of patent law. We know the rules and requirements of the Patent Office. We can proceed in the quickest, safest and best ways in preparing an application for a patent covering your idea. Our success has been built on the strength of careful, efficient, satisfactory service to inventors and trademark owners located in every state in the Union.

No Charge for Information on How to Proceed

The booklet shown here contains valuable information relating to patent procedure that every inventor should have. And with it I will also send you my "Record of Invention" form, on which you can sketch your idea and establish its date before a witness. Such evidence may later prove valuable to you. Simply mail the coupon and I will send you the booklet and the "Record of Invention" form, together with detailed information on how to proceed and the costs involved. Do this NOW. No need to lose a minute's time. The coupon will bring you complete information entirely without charge or obligation.

Clarence A. O'Brien
Registered Patent Attorney

Member of Bar of: Supreme Court of the United States; Court of Appeals, District of Columbia; Supreme Court, District of Columbia; United States Court of Claims.
Practice confined exclusively to Patents, Trademarks, and Copyrights

Mail this Coupon Now!

Clarence A. O'Brien
Registered Patent Attorney
88-S Security Savings & Com. Bank Bldg., Washington, D. C.

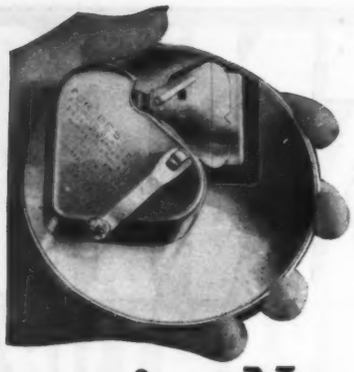
Please send me your free book, "How to Obtain a Patent," and your "Record of Invention" form without any cost or obligation on my part.

Name.....

Address.....

.....

(Important: Print or Write name clearly)



Amazing New Way to Shave
Astonishes Experts

Keen, velvety shaves forever and no more blades to buy! That's what the amazing invention of a St. Louis man offers you today.

KRISS-KROSS—the super-stropper prolongs the life of any-make blade for months and even years! Strops on diagonal. Employs barbers' secret principle. Gives keenest edge that steel can take in only 11 seconds. Automatic timer signals when blade is done. You'll say that magic device is almost human!

Right now the inventor is offering a new kind of mystery razor FREE—to introduce KRISS-KROSS stropper. Really 3 razors in one. Instantly adjustable. Absolutely unique and astonishing!

Write for FREE Offer

Amazing KRISS-KROSS inventions are never sold in stores. Write for details and FREE mystery razor offer.

AGENTS wanted. Generous commissions and big profits. H. King made $66 a day. J. C. Kellogg made $200 in 7 days. Even spare time workers make $6-12 a day extra. Nine out of 10 men want to buy on sight. Really astonishing. Get details at once. Mail coupon today.

RHODES MFG. COMPANY

Dept. H-241 1418 Pendleton Avenue St. Louis, Mo.

RHODES MFG. CO., Dept. H-241
1418 Pendleton Avenue, St. Louis, Missouri
Without obligation, please send me details of your amazing KRISS-KROSS stropper and FREE 3-way razor. Also proposition showing generous agent commissions.

Name.....

Address.....

City.....State.....

☐ Check here if interested in becoming representative.

UNITED STATES CAPITOL

PATENTS

DON'T LOSE YOUR RIGHTS
TO PATENT PROTECTION

Before disclosing your invention to anyone send for blank form **"EVIDENCE OF CONCEPTION"** to be signed and witnessed. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request.

LANCASTER & ALLWINE
274 Ouray Building
WASHINGTON, D. C.
Originators of forms "Evidence of Conception."

Make More Money
Read the Money Making Opportunities on pages 116 to 135 of this issue.

Chief of Battalion

(*Continued from page 125*)

another breath. Then habits of obedience rose swiftly in him. Dargan was acting chief.

"Close this door," Kellogg bade. "Tight! Get around front, men. Shut down your pipe. Drag now, drag! Around front!"

In the courtyard he heard Dargan's voice.

"Second line off Engine 14, I say. You, Truck 12, ventilate! Ventilate! Open her up! Get some air on it! Lost time enough!"

KELLOGG ran ahead, back the way he had come. The line of Engine 14, Dargan's company, already twisted into the south basement door. Kellogg followed it. Hotter here, immeasurably hotter.

"Down!" he commanded. "Hit the ground!"

He dropped to his knees. There was less smoke close to the floor. He hitched forward. This entry was exactly like the one he just had left. Dargan's crew already had opened the insulated doors. They crouched at the left; Kellogg passed them.

McSweeney crawled up behind him, lugging the nozzle. Hennessey followed, dragging line. Stein tripped midway to the second door, sprawled there, panting. Burton, who came last, eased the stiff, throbbing hose outside around the corner of the building.

"Ready!" Kellogg grasped the tip. He pulled upward, then forward, on the shut-off valve. Water, released from its fabric bonds, pressed a stout white pillar against the fire.

A little behind him and to his right, Engine 14 was washing down the ceiling beams. Fire filled the long corridor ahead. Flame in fantastic shapes blazed orange and purple with wisps of ultramarine. Smoke fluttered in yellow, opaque pennants.

HEAT . . . smoke . . . burned air . . . ammonia . . . and behind it the wind from the river, sweeping through from the rear. Captain Kellogg muttered rebelliously and pulled his head deeper into the collar of his rubber coat. This was no place to attack it! He knew it now, if ever he had been uncertain. Lick it from here? It couldn't be done!

He aimed determinedly at a new spout of flame on the wall. Ammonia rasped his throat. His white pillar of water ploughed into the turmoil ahead, eight hundred gallons a minute. Kellogg coughed; tough on a good crew, having to eat smoke like this. He hugged the nozzle, felt the throb of his engine back in the street, eight hose lengths away, the churn of its jowly piston pumps, the rumble of its racing motor.

Good old engine! She'd do her best!

Suddenly in the turmoil behind him he heard Dargan crying out, bursting through the door. He was shouting his name: "Kellogg! Kellogg!"

The commander of Engine 26 sloughed deafly at the flame. He'd had enough of Dargan for one night. A sudden splash of water dropped from the ceiling above his head. He knew what that indicated. Truck 12 had dragged its line up to the roof and was wetting down the elevator shaft. Dargan lurched toward him through the gloom.

"You, Kellogg!" he shouted. "Are you quittin' on me? Up and at it! Move in ten foot and give some firemen a chance back here!"

Kellogg hitched ahead. He told himself vehemently that no man could live ten feet farther in with all that wind blowing through. More water dripped from the ceiling. More engines were working; must be fourth-alarm companies.

"Get up forward, I tell you!" Dargan cried. "Hit her right!"

Kellogg turned. He saw Dargan kneeling in the smoke beside him. The old man's rubber coat was open. Firelight shone in his eyes, in his unprotected eyes that should have baked in such heat. His helmet was pushed half off his square gray head. His mouth was spread wide, shouting.

"Show you how a fireman does it!" he howled into Kellogg's ear.

He had pulled the hose of Engine 14 behind him through the insulated door. Kellogg tugged on his own line. It would not move. McSweeney sprawled across it. Kellogg prodded him with his boot. McSweeney lifted convulsively to his knees, then dropped back.

"Get him out!" Kellogg ordered.

He saw Hennessey drag McSweeney toward air; pious-looking Hennessey, his mouth wide, uttering horrible words. The hose moved more easily now under Kellogg's baked fingers. He advanced six inches. Dargan advanced beside him.

"We kin beat it!" the old man argued.

THE fire retreated suddenly and as suddenly leaped forward again. Another hot stream of dirty water from above splashed upon Kellogg's neck. He moved his head slowly, trying to shake off his helmet. It must be scorching the hair on his scalp, the way it felt. His elbows slipped, and rested on the hot floor—more comfortable that way.

The ammonia was knocking him out, he had wits enough to realize. His mind refused to act. How could old Dargan stand it, if he, a younger man . . .

He heard a warning shout beside him. He saw Dargan rise to his knees, turn halfway around, drop back. An immense wrench of timbers thundered above the noise of the fire.

"Cut off!" Dargan cried.

Kellogg lifted to one elbow. Behind them, a section of ceiling had tumbled. Skulking flames, released from concealment, played excitedly with new drafts. The two lines of hose wormed through under a heap of wreckage. Of his own crew, or of Captain Dargan's, Kellogg's seared eyes could make out no sign. The passage was blocked. Fire marched triumphantly at them.

"Cut off!" Dargan was screaming.

Kellogg lifted his hands. The nozzle did not respond to his urging. Opening his eyes, he saw that it lay upon the floor, spilling its water uselessly. He tried to pick it up. His helmet dropped as he lunged forward. Better off; not so heavy. He touched the brass pipe—and couldn't lift it. Sloth overcame him. He was dizzy, needed to sleep. He sank down into the muddy pools on the hot cement floor and there stayed; nothing mattered. . . .

SPRAY revived him. Spray, and a terrible, croaking voice hurling epithets at him. And the answering cries of men. The cellar was darker. There was less flame. Kellogg could see nothing. Barbed wire lodged in his throat. His nose was afire. Ammonia. Smoke. Heat. Burned air. Then Dargan's voice, still pouring out abuse, commanding him to waken, to sit up, to show some guts.

Hands gripped his rubber jacket. His toes dragged on cement. His eyes felt the mercy of cool air.

"I'll give him a hypodermic," someone said.

At noon the next day Chief Marshal Peter G. Sullivan stopped his car jerkily and remarked that he'd be durned. In a wicker chair on the front porch of Captain Kellogg's house sat the captain himself. He was wadded with bandages and wore a blanket around his shoulders. Opposite him, smoking a cigar, the squat, square figure of Captain Kerry Dargan sat astride the porch rail.

"Not by the holy hydrants you won't refuse it!" Dargan was (*Continued on page 127*)

Chief of Battalion

(*Continued from page 126*)

saying as the marshal sauntered up the walk. Sullivan tramped heavily up the steps.

"Hello, Kellogg. Hello, Dargan," he said.

"Have a chair, Pete," Captain Dargan offered, "and I'll do the first talkin'. This Johnny-Jump-up was right yesterday. I should have attack-ted that beef house from the north."

"Aye, you should," Sullivan granted. "I see that, Kerry, soon's I get there on the 4–11. That's why I sent the rest in from behind. You was wrong. You must of been neglectin' your job of late, Kerry. Must of been readin' too many books. I thought so, day afore yesterday, when they graded the papers for bat chief. You was a false alarm on all the fire fightin' questions, Kerry. Only thing is, you got all the hydraulics stuff right."

"Hydraulics?"

"Wait a minute. You did your talkin'." The marshal turned, searching a cuspidor. Finding none, he spat over the porch rail. "You muffed the hydraulics, Kellogg," he said impartially. "Got the rest, the straight fire business. But you won, Kerry. You had two points the best o' him."

"ME?" Dargan demanded. "Me? I withdraws!"

"Withdraw? That leaves Kellogg—"

"Not me, sir," Captain Kellogg spoke doggedly. "A chief's got to be up on hydraulics; rule book says so."

Marshal Sullivan took off his broad-rimmed black hat and scratched his head.

"So there you are," he told his first assistant later, back in central office. "Neither man'll have it. Kellogg says Dargan drug him out, saved him from being burnt up. Says if a man can't stand a little smoke he ain't fit to be chief. Dargan says he won't ride into no chief's job on a book. Says he don't think much of hydraulics. It's knowin' about such things as wind that counts. Won't have it, neither one. Dargan run me off the porch."

"But who's battalion chief?" the assistant marshal asked.

"Nobody," Sullivan answered. "Nobody. The job's vacant. We're just where we was. Dargan, bein' rankin' captain, still is actin' chief. Only one thing's different," he paused, wiping the sweat from his red face: "we got a new job in the department. It's actin' advisory assistant to actin' battalion chief. Dargan give it to Kellogg."

"And Kellogg?"

"Durned if he don't say yes!"

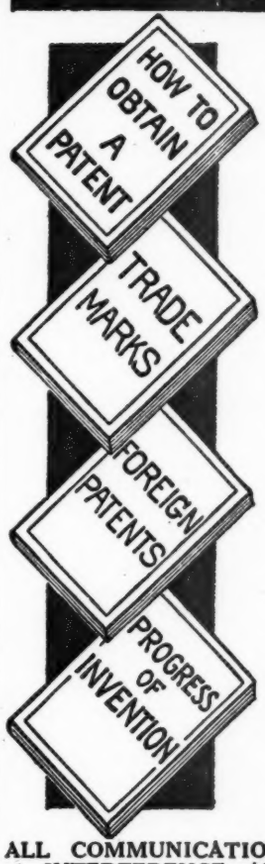
Let Your Boy Build His Toys!

HOMEMADE toys constructed by children with their own hands possess a value not found in the most elaborate playthings displayed in stores or built by parents, says Dr. Lovisa C. Wagoner of Iowa State College, who has made a special study of the subject.

Not long ago Dr. Wagoner asked a group of mothers to describe the best homemade toys their children played with. Of ninety-five toys described, half were made by the children themselves. Although a large proportion of the children were less than five years old, they showed surprising ingenuity in creating playthings out of old boxes, string, paper, spools, and other odds and ends.

Not only do such toys stimulate inventiveness, says Dr. Wagoner, but they also encourage the qualities of self-assertion and mastery of available materials; qualities which will prove invaluable in later life.

PATENTS TRADE-MARKS AND COPYRIGHTS



OUR OFFER:

Your first step—

The inventor should write for our blank form "RECORD OF INVENTION." This should be signed, witnessed and returned to us together with model or sketch and description of the invention for INSPECTION and INSTRUCTIONS FREE.

Our Four Books Mailed Free to Inventors

Our Illustrated Guide Book

HOW TO OBTAIN A PATENT

Contains full instructions regarding U. S. Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described.

OUR TRADE-MARK BOOK

Shows value and necessity of Trade-Mark Protection. Information regarding *Trade-Marks and unfair competition in trade.*

OUR FOREIGN BOOK

We have Direct Agencies in Foreign Countries, and secure Foreign Patents in shortest time and at lowest cost.

Progress of Invention

Description of World's Most Pressing Problems by Leading Scientists and Inventors

ALL COMMUNICATIONS AND DATA STRICTLY CONFIDENTIAL
INTERFERENCE AND INFRINGEMENT SUITS PROSECUTED

IMPORTANT

TO MAKE YOUR CASE SPECIAL AND AVOID DELAY YOU SHOULD HAVE YOUR CASE MADE SPECIAL IN OUR OFFICE to secure protection, save correspondence and obtain early filing date in Patent Office. To secure special preparation of your case send $25.00 on account with model or sketch and description of your invention.

Highest References—Prompt Attention—Reasonable Terms

Private Office, Victor J. Evans, with View of Patent Office Through Window

WRITE TODAY

Free Coupon

VICTOR J. EVANS & CO.

Patent Attorneys

Main Offices: 760 Ninth St., Washington, D.C.

New York Offices 1007 Woolworth Bldg. | Philadelphia Offices 518-519 Liberty Bldg. | Pittsburgh Offices 514 Empire Bldg.
Chicago Offices, 1114 Tacoma Bldg. | San Francisco Offices, Hobart Bldg.

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name..... Address.....

$351.00 CLEARED IN ONE DAY

So writes W. H. Adams of Ohio in August 1925. V. A. Marini of California reports **$11275** sales in 3 months. Jacob Gordon of New Jersey "**$4000** profits in 2 months." Alexander of Penna. "**$3000** profits in four months." Ira Shook **$365** sales in one day. Bram bought one outfit April 5 and 7 more by August 28. Iwata, bought one outfit and 10 more with a year. Mrs. Lane of Pittsburgh says "sold **8000** packages in one day." J. R. Bert says "only thing I ever bought that equaled advertisement." John Culp says: "**Everything going lovely.** Crispette wrappers scattered all over town. It's good old world after all." Kellog, **$700** ahead end of second week.

WE START YOU IN BUSINESS

Furnish secret formulas, raw material and equipment. Little capital required; no experience needed.

Build A Business of Your Own

No limit to the sale of Crispettes. Everybody likes them. It's a delicious food confection. Write for facts about a business that will make you independent. Start now, in your own town.

Profits $1000 a Month Easily Possible

Send postal for illustrated book of facts. It contains enthusiastic letters from others—shows their places of business, tells how and when to start, and all information needed. Free. Write now!

LONG-EAKINS COMPANY
747 High Street Springfield, Ohio

HOME-STUDY COURSES
THAT LEAD TO BUSINESS CAREERS

DO YOU WANT an important, high-salaried position? You can have one if you can do the work. LaSalle experts will show you how, guide you step by step to success and help solve your personal business problems thru the time-saving LaSalle Problem Method. Our *salary-increasing plan* enables you to prepare during your spare hours, without interference with your present duties. Simply mark on the coupon the field in which you desire success, and we will mail you a valuable book describing the opportunities in that field, together with an outline of our *salary-increasing plan*. Also copy of "Ten Years' Promotion in One." There is no cost or obligation. Find out how the *salary-increasing plan* starts average men and women on the high road to success and financial independence. Check and mail the coupon NOW.

— — — *Find Yourself Thru LaSalle* — — —

LASALLE EXTENSION UNIVERSITY
The World's Largest Business Training Institution
Dept. 783-R Chicago

I should be glad to learn about your *salary-increasing plan* as applied to my advancement in the business field checked below. Send also copy of "Ten Years' Promotion in One," all without obligation.

- ☐ Business Management
- ☐ Higher Accountancy
- ☐ Traffic Management
- ☐ Modern Salesmanship
- ☐ Railway Station Management
- ☐ Law—Degree of LL.B.
- ☐ Commercial Law
- ☐ Industrial Management
- ☐ Modern Foremanship
- ☐ Personnel Management
- ☐ Banking and Finance
- ☐ Modern Business Correspondence and Practice
- ☐ Expert Bookkeeping
- ☐ C. P. A. Coaching
- ☐ Business English
- ☐ Commercial Spanish
- ☐ Effective Speaking
- ☐ Stenotypy

Name .....
Present Position .....
Address .....

Make More Money
Read the Money Making Opportunities on pages 116 to 135 of this issue.

A New Era of Huge Bridges

(*Continued from page 25*)

on a bridge made from only three one-inch ropes. A log bridge for the same span would require two timbers twenty-four inches square and over 100 feet long, the cutting and placing of which would be a superhuman task for natives.

"You doubtless know that modern wire-cable bridges, which stretch a half-mile or more in a series of graceful swings, are due to the genius of John A. Roebling. He started the first wire mill in this country only three quarters of a century ago. A few years later he startled the world with his kite over the roaring Niagara Falls, which carried a string that began the first great wire-cable bridge. This 821-foot span was one of the few suspension bridges ever used for railroad traffic. It served for almost half a century.

"THIRTY years later Roebling devised the astonishing sweep of 1596 feet across the East River of New York. He had found that cables made up on the ground were unwieldy, and the wires would not stay in place. So he invented our present method of spinning the cables in place. He died before the Brooklyn Bridge was begun, from injuries received during the surveys. But his monument, designed largely by rule of thumb, held all records for length for many years, being exceeded at last by the Firth of Forth bridge in Scotland, a steel cantilever type, and in 1903 by the Williamsburg span over the East River, only four and one half feet longer in span.

"It was only two years ago that the Bear Mountain bridge over the Hudson attained the 1632-foot record, and only last year that the Philadelphia-Camden span achieved 1750 feet, almost exactly one third of a mile. But now plans are under way for a span between Detroit and Windsor, Ontario, of 1850 feet; the Hudson River bridge at 179th Street, New York, 3500 feet; and the Golden Gate bridge, 4000 feet. In addition, Gustav Lindenthal has planned another Hudson River crossing at 59th Street, 3240 feet, while the projected Liberty Bridge over the Narrows of New York will require a span of about 4500 feet."

I had heard of an unusual great suspension bridge, the Florianopolis bridge, designed by Dr. Steinman for a remote part of South America, and I asked him to give me some details.

"IT WAS conceived by the Governor of Santa Catharina, a remote state of southern Brazil, to connect his island capital with the mainland," he explained. "He did not live to see his lifelong ambition fulfilled. Many other disappointments came to all of us before we completed it.

"Its most unique feature, perhaps, is the first use of heat-treated eyebars in place of wire cables. This new steel is three times as strong as ordinary steel. The unique eyebars facilitated the design of a structure with four times the rigidity and with one third less steel for stiffening. We also designed a novel method of taking care of expansion and contraction, by permitting the main towers to rock on their bases. As a result, this bridge proved to be the most economical suspension bridge ever built.

"Yes, we had many troubles," he recalled. "Our preliminary surveys, unavoidably limited, indicated rock was available for anchoring the cables on the mainland. When work was under way I received a cablegram in New York that no rock was found. I was asked to cable a new design, for a bridge six thousand miles away! By extreme efforts we not only made designs for a new type of foundation, but did it overnight, and cabled the new plans the following day.

"At another point, forty-foot steel sheet piles were provided to reach bedrock, indicated at thirty-eight feet below water level. Nothing but clay was found, and no piles of greater length were procurable in South America. Shipping from this country meant months of delay. The engineers rose to the occasion by digging straight down from the bottom of the cofferdam until they struck rock, sixty feet below water level, filling the pit with masonry, and building upon that. American resourcefulness such as that is known the world over."

I asked Dr. Steinman how heavy bridge materials could be moved far into the interior of such countries.

"Steel parts and machinery are designed and built in pieces which will fit the holds of vessels and limited hoisting equipment. When necessary, they are designed to be packed hundreds of miles on native animals. A steel cable several hundred feet long, for instance, is unrolled into a number of connected coils, each carried by a mule. If one should go over a cliff, the rest would follow—but the cables will always arrive, and in one piece!"

THIS was my clue for introducing the subject of accidents, for I had hesitated to inquire how many men are killed per bridge erected.

"So scientifically are modern bridges detailed and erected," he said, "that very large spans are now built thousands of miles from home, with much native labor and without a single fatality. The pioneers were the ones who had to take the chances. Without electric power or modern equipment the marvelous structures of bygone days required superb daring, and often at the cost of life and limb. Remember that lofty bridges are nearly always located above treacherous water.

"One of the most tragic chapters in bridge building," continued the engineer, "was that of the Quebec cantilever across the St. Lawrence. Its 1800-foot span still holds the world's record for all spans. Efforts to skimp in material and in engineering services resulted in violation of some principles of conservative design. Deficient sections were built. On August 29, 1907, a bottom chord buckled, causing the collapse of the entire structure of forty million pounds, and the death of one hundred workmen.

"Investigation gave us many valuable lessons. The Canadian government took over the project, prepared new designs under the best practice, and almost doubled the weight of metal. Yet one defect remained, either in a part or in the method of erection. On September 11, 1916, while lifting the 640-ton span which was to close the gap, and before the eyes of thousands of spectators, something gave way and the huge truss crumpled into the river, carrying thirteen men with it. But a year later an identical truss was lifted into place without incident.

"TODAY we can meet almost every natural foe on its own ground, from high water and floods to wind, snow, ice jams, and temperature changes ranging from sixty below to 120 above. Yes, and we even have to provide against fire. When the Williamsburg Bridge was being built over the East River of New York, a fire broke out on the scaffolds high up on a tower. It damaged some of the 7696 wires in the eighteen-inch cable, which had to be spliced. Since then good practice permits only steel scaffolds at such danger points."

A few weeks ago twenty thousand people of the San Francisco Bay region, massed to view the second largest cantilever bridge on the continent, observed a thrilling incident. The closing span, 750 tons of steel, was raised 15[illegible] feet in a few minutes. (*Continued on page 10*

A New Era of Huge Bridges

(*Continued from page 128*)

without a hitch and without a man on bridge or closing span. Never before in history had the weight of ten thousand men been lifted so quickly and safely. I asked Dr. Steinman, the designer, how it was done.

"It was simply a case of planning each detail beforehand," he explained. "At each corner of the closing span, floating on barges, a two-and-one-half-inch cable was fastened, running over a sheave on the overhanging bridge, and down to a wooden box filled with five carloads of sand. When it was released the span naturally rose like an elevator, the four counterweights of sand being slightly heavier than the span. It required just half an hour to lift each closing span. The novel plan saved time by permitting assembly of the spans while the bridge was being erected.

"THIS Carquinez Straits bridge involved several unique features. The foundations, 132 feet deep, are in the deepest water in which such work was ever attempted. The tide is about seven feet per second, and has a range of almost nine feet. Teredos caused one group of piles to collapse in a few weeks. We had to build a false wall around the timber cofferdam, waterproof it, and fill the water between with poisonous copper sulphate."

"What will be the ultimate limit of span?" I asked.

"Speaking broadly, we have far to go before reaching a mechanical limit. Before the weight of long spans becomes too great for present types of piers, no doubt we shall have even stronger and lighter materials. Every pound of metal can now be placed where it will do the most good. Clumsy, massive designs of the past are giving way to more graceful and more scientific structures.

"Erection methods, too, are becoming faster, safer, more efficient. The Brooklyn Bridge took ten years to build. Today a bridge of equal size could be built in four years or less. Holton D. Robinson (Dr. Steinman's partner) so improved the methods of spinning large suspension cables, that the great twenty-one-inch and thirty-inch cables of the Manhattan and Philadelphia-Camden Bridges, which he supervised, were spun in only three and four months, respectively. The Brooklyn cables, with slightly more than half as much wire, required twenty-one months.

"THERE is no reason, when dense traffic demands, why single suspension spans two miles in length cannot be built. You can get some conception of this span when you realize that it is more than three quarters the distance across Manhattan Island.

"We are justified in believing that future bridges will be executed on so grand a scale that in comparison, our present vaunted structures will appear as slight and crude as the primitive bridges built by the aborigines in the Himalayas or the Andes now appear to us."

New Theory for Poisoning

THAT poisons kill by electrically shocking the nerves and brain, is the remarkable theory advanced by Dr. R. Beutner, of the University of Louisville medical school. How poisons actually operate to bring about death has never been satisfactorily explained. In his experiments, Dr. Beutner placed strong poisons in a new type of electric cell, producing a marked electrical effect, often a considerable drop in voltage.

No nonpoisonous substance acted in the same way, he reported. He suggests, therefore, that electric charges produced by a violent poison may kill a man in much the same way as would a bolt of lightning.

PATENTS

TRADE-MARKS ·· DESIGNS
FOREIGN PATENTS

MUNN & CO.

PATENT ATTORNEYS

Associated since 1846 with the Scientific American

1583 SCIENTIFIC AMERICAN BUILDING
24 WEST 40th STREET
New York City

522 SCIENTIFIC AMERICAN BUILDING
Washington, D. C.

1311 TOWER BUILDING
Chicago, Ill.

664 HOBART BUILDING
San Francisco, Cal.

519 VAN NUYS BUILDING
Los Angeles, Cal.

Books and Information on Patents
and Trade-Marks By Request.
Associates in all Foreign Countries.

INVENTIONS Commercialized
ON A CASH OR ROYALTY BASIS
PATENTED or UNPATENTED
In Business 25 Years - Complete Facilities - References.
Write ADAM FISHER MFG. CO.,
183-D Enright Ave. ST. LOUIS, Mo.

INVENTORS who derive largest profits know and heed certain simple but vital facts *before* applying for Patents. Our book *Patent-Sense* gives those facts; sent *free*. Write LACEY & LACEY, 648 F St., Washington, D. C. Established 1869.

INVENTORS PROTECT YOUR IDEAS

Send for our Guide Book, **HOW TO GET YOUR PATENT**, and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention for **Inspection and Instructions Free. Terms Reasonable. Best References.**

RANDOLPH & CO.
Dept. 130, Washington, D. C.

NAME.....
STREET.....
CITY.....STATE.....

TRAVEL - for 'UNCLE SAM'

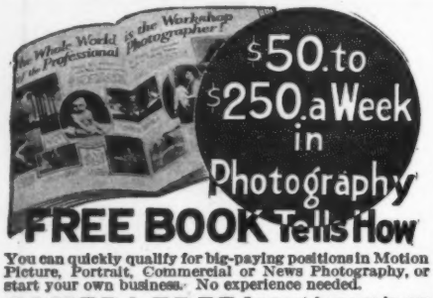
RAILWAY POSTAL CLERKS
MAIL CARRIERS—POSTOFFICE CLERKS
$1700 to $2700 a Year for Life

No "lay-offs" because of strikes, poor business, etc.—sure pay—rapid advancement. City and country residents stand same chance. Common sense education sufficient—no political influence.

STEADY WORK Cut coupon and mail it before turning the page.

MEN—BOYS
18 to 45
Use Coupon Before You Lose It

COUPON
FRANKLIN INSTITUTE, Dept. K-264, Rochester, N. Y.
Rush to me, entirely free of charge, 32 page book with (1) A full description of the position checked below; (2) Full particulars telling how to get appointment.
☐ Railway Mail Clerk ($1850 to $2700)
☐ Postoffice Clerk ($1700 to $2300)
☐ City Mail Carrier ($1700 to $2100)
☐ Rural Mail Carrier ($2100 to $3300)
Name.....
Address.....



$50 to $250 a Week in Photography
FREE BOOK Tells How

You can quickly qualify for big-paying positions in Motion Picture, Portrait, Commercial or News Photography, or start your own business. No experience needed.

CAMERA FREE Learn at home or in our great New York Studios. Earn while learning. Write today for Free Book, Job Chart and Free Camera offer.

NEW YORK INSTITUTE OF PHOTOGRAPHY
Dept. 5 10 West 33rd St. New York

Sell LIFE PROTECTION
$50 to $100 A Week To AGENTS
Amazing Anti-Glare Device For Automobiles

prevents loss of life and makes big money for salesmen. Motorists buy on 30-second demonstration. Treated by secret process. Shields the eyes from dazzling head-lights. Also used by day as a rear-view mirror. Unique, mystifying. Big season now. Write for details of our generous trial offer and sensational money-making plan with special discount prices to agents. No obligation. Address

THE LEE SEE CO., Dept. 67
Kewaunee, Wisconsin

READ! Rhanney sold 108, in less than a week—Ballance made $40 in a day—$200 in a week—Grissinger sold six first fifteen minutes. It's a winner for salesmen.

LEARN TO Mount Birds

We teach you At Home by Mail to mount *Birds, Animals, Heads, Tan Furs and Make Rugs.* Be a taxidermy artist. Easily, quickly learned by men, women and boys. Tremendously interesting and fascinating. Decorate home and den with beautiful art. *Make Big Profits from Spare Time Selling Specimens and Mounting for Others.*

Free Book—Yes absolutely Free—beautiful book telling all about how to learn taxidermy. Send Today. You will be delighted. Don't Delay!

Northwestern School of Taxidermy B-339 Elwood Bldg. OMAHA, NEB.

Learn Advertising at HOME

Many of the highest paid men in the world are advertising men. You can learn easily and quickly at home during your spare time. We guarantee satisfaction. Bigger opportunities now in advertising than ever before. Constant demand for our graduates at splendid pay.

Send for FREE Book. Giving interesting information and vital facts—just what you want to know about advertising. Write today.

PAGE-DAVIS SCHOOL OF ADVERTISING
Dept. 1368 3601 S. Michigan Ave., Chicago, U. S. A.

"Patents of commercial value financed on royalty basis without expense to inventor. Mail models and copies of patents or full details to Kamstone Holding Corp., 41 East 42nd Street, N. Y. C."

Learn to Paint SIGNS and SHOW CARDS

We quickly teach you by mail, or at school, in spare time. Enormous demand. Big future. Interesting work. Oldest and foremost school.

Learn To Earn $50 To $200 Weekly

John Vassos, N. Y., gets $25 for single show card. Crawford, B. C., writes: "Earned $200 while taking course." Don't delay. Send today for complete information, samples and guarantee.

DETROIT SCHOOL OF LETTERING
159 Stimson Ave. Est. 1899 DETROIT, MICH.

DRAWING IS A WAY TO FORTUNE

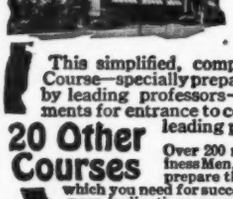
All Hafed, a Persian farmer, sold his acres to go out and seek his fortune. He who bought the farm found it contained a diamond mine which made him fabulously rich. All Hafed overlooked the great opportunity at his door to go far afield in search of wealth—which illustrates a great truth.

EARN $200 TO $500 A MONTH

If you like to draw, develop your talent. Your fortune lies in your hand. Present opportunities for both men and women to illustrate magazines, newspapers, etc., have never been excelled. Publishers are buying millions of dollars' worth of illustrations each year. The Federal Home Study Course has been prepared by such famous artists as Neysa McMein, Norman Rockwell, Charles Livingston Bull, Clare Briggs, Sidney Smith, Fontaine Fox and fifty others. Each student gets individual personal attention. No previous training is necessary. Every step is clear and simple.

FREE, illustrated catalog on request. Shows work of students and testimonial letters. Complete outline of course with all the details. Just write your name, age, occupation and address in the margin and send it to us.

Federal School of Illustrating
7147 Federal School Bldg., Minneapolis, Minn.



High School Course in 2 Years

This simplified, complete High School Course—specially prepared for home study by leading professors—meets all requirements for entrance to college, business, and leading professions.

20 Other Courses

Over 200 noted Engineers, Business Men, and Educators helped prepare the special instruction which you need for success. No matter what your inclinations may be, you can't hope to succeed without specialized training. Let us give you the practical training you need.

American School
Drexel Ave. & 58th Street
Dept. H-B-75 Chicago

Money Back When You Finish If Not Satisfied

American School, Dept H-B-75 Drexel Ave. and 58th St., Chicago
Send me full information on the subject checked and how you will help me win success in that line.

.....Architect	.....Electrical Engineer
.....Building Contractor	.....General Education
.....Automobile Engineer	.....Lawyer
.....Civil Engineer	.....Mech. Shop Practice
.....Structural Engineer	.....Mechanical Engineer
.....Business Manager	.....Steam Engineer
.....C. P. A. & Auditor	.....Sanitary & Heating
.....Bookkeeper	.....Surveyor & Mapping
.....Draftsman & Designer	.....High School Graduate

Name.....
Address.....

Broncho-Busters of the Air

(*Continued from page 29*)

would carry before failing. One model of every important part has been destroyed in this manner, so that before the first plane has been assembled ready for flight nearly a whole airplane has been destroyed.

With such careful work it is virtually impossible that the plane will fall to pieces in the air, which many people watching an initial test flight think is likely to happen. Other things may happen, but no test pilot who has watched the construction of an airplane in a good factory will worry for fear bits of it will stray off in mid-air.

Before he takes up that plane, the pilot will have a lengthy conference with the chief engineer, who will suggest how it should be flown and how it may be expected to perform. The pilot has flown from twenty to forty different types of planes, among which at least two or three will bear some resemblance to the type about to be tested; therefore he has a good idea of how the new machine will act and feel to him.

AFTER their conference, the chief and the pilot stroll out to the plane, and it is probable that they are feeling more tense than they look. For one of them is to take into the air a brand-new creation, worth perhaps $40,000, in which all the hopes of the factory are riding; the other is to learn whether his creation is good, no good, or "just another airplane"—of which Uncle Sam desires no duplicates, thank you.

The pilot buttons his coveralls, buckles his helmet and the harness of his parachute, pushes his goggles up on his head, and climbs aboard the huge bomber.

"Switches off! Gas on! Prime her!" says the pilot, as he pumps gasoline with the hand pump until the motor pump starts and relieves him of that job.

A mechanic on the engine platform primes the cylinders with six pushes of a plunger, turns vigorously the handle of the inertia starter, calls, "Contact!" and engages the starter. The starter flywheel, turning 35,000 revolutions a minute, engages through gears the motor's crank shaft—and the engine wakes up and roars. It turns over slowly, warming up, while the pilot watches his gas and oil pressure gages.

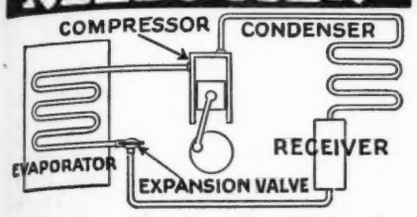
He snaps on his safety belt, tries his controls, and sees that the stabilizer, or tail-plane, is set correctly. He has lived with that plane since it was a dream on paper, watched it grow to a beautiful silver-colored reality. Now it is his at last, to play with or fight with, to handle gently or roughly—gently, he hopes!

AT LAST the motor is warm enough. Steadily the revolution counter swings around the dial as the pilot advances the throttle and the engine roars into full power. It runs "all out" for a minute before he throttles down, and waves the chocks from before the wheels. Then he taxies to the down-wind end of the field, swings into the wind, checks his instrument readings, and opens the throttle steadily.

The plane rolls along the runway, gathers speed, lifts its tail, goes faster. The pilot eases back on the control wheel, swings it a trifle to level the wings, pulls back gently—and the plane is off the ground. He pushes forward on the wheel to prove to himself that he has fore and aft control, and rocks the wings laterally. He is only a foot in the air, and can shut off and land if things don't feel right.

But control seems normal. He eases back the wheel, finds he is climbing at too steep an angle, pushes forward again, adjusts the stabilizer—and notes that the plane is slightly tail-heavy, a minor (*Continued on page 131*)

NEW INDUSTRY NEEDS MEN



ELECTRIC Refrigeration Calls You! The over-night development of this billion dollar industry has created a *shortage of trained men.* Production, service, installation and sales positions are crying for competent men to fill them.

Electric Refrigeration is today's biggest opportunity. Greater profits than auto, electricity or radio! *Learn at home*—be ready to fill a HIGH PAY POSITION in just a few months.

Get in on ground floor! Illustrated book of opportunities in this magic new industry FREE. Be the first in your neighborhood to learn about it. *Write today.*

UTILITIES ENGINEERING SERVICE
Educational Division
3120 N. Clark St., Chicago

Auto Owners Wanted to sell HYDRO *Insured* TIRES—the only tires in America Insured for One Year against all road hazards *regardless of mileage.* Insurance Policy with every tire. Made by the only tire factory in America selling its product through authorized Salesmen-Agents. We offer opportunity of life-time to establish profitable tire business of your own. *No capital required.* Sales Kit and advertising helps furnished. Exclusive territory granted. Write today for catalog and complete information about the Hydro Agency Plan. ADDRESS NEAREST BRANCH. Dept 16.

HYDRO *Insured* TIRES
"The Most Beautiful Tire in America"
HYDRO-UNITED TIRE CORPORATION
POTTSTOWN, PA. CHICAGO, ILL.

$148.00 A Week! Driving Around

Making DEMONSTRATIONS. New Vapor MOISTURE HUMIDIFIER and GAS SAVER. For all autos, trucks, tractors, busses, taxis, engines. Makes engines run ALL THE TIME with the same wonderful efficiency they do on a cool, moist night. Amazing records.

66 Miles on 1 Gallon reported on a Ford. Chevrolet 47; Dodge 28; Buick 31½; Overland 47; Essex 33; etc. Thousands of others. **Moisture in engine does it.** Amazing mileage; added power; faster pickup; more snap and pep; frees engine from hard carbon troubles. Quick Sales—Big Profits—Start NOW.

1 FREE to Introduce Factory Sales - Distributors wanted everywhere. $500 to $1500 monthly. Spare or full time. WRITE TODAY. Address: **Walter Critchlow, Inventor, EA-120 St., Wheaton, Ill.**

"STAMMERING Its Cause and Cure"

You can be quickly cured if you stammer. Send 10 cents, coin or stamps, for 288-page cloth bound book on Stammering and Stuttering. It tells how I cured myself after Stammering and Stuttering for 20 years.
BENJAMIN N. BOGUE
7543 Bogue Bldg., 1147 N. Ill. St. Indianapolis

PATENTS

BOOKLET FREE — HIGHEST REFERENCES
PROMPTNESS ASSURED — BEST RESULTS

Send drawing or model for examination and advice
WATSON E. COLEMAN, Patent Lawyer
724 Ninth Street Washington, D. C.

PATENTS

Trade-marks, Copyrights, Patent Litigation, Handbook with illustrations, 100 mechanical movements. Sent free on request.
ALBERT E. DIETERICH
Formerly member Examining Corp. U. S. Patent Office
Patent Lawyer and Solicitor
27 years' experience
681-A Ouray Bldg. Washington, D. C.

Broncho-Busters of the Air

(*Continued from page 130*)

fault. A bump under the left wing throws it up; a quarter turn of the wheel deflects the ailerons and puts the wing down. The plane answers readily for one of its size, but the control works too hard.

The pilot has been in the air five seconds, and he has discovered two minor faults. All that he will learn eventually about this plane will not come so quickly. But the flying characteristics of the craft are known to him in the first few minutes.

He retards the throttle to easy cruising speed and looks at his gages. Oil and gas pressure, water and oil temperatures, are normal, though oil is running warm. Instinctively his mind will focus on the gage marked "Oil Out." Though he will forget none of the others, that one will stand out.

THE engine is purring like a big cat; the plane is climbing buoyantly. At 500 feet the pilot pushes forward on the control wheel, gains more speed, and does a gentle turn. Later he will turn with the nose of the plane stuck high in air, turn right at the stalling point, turn any way. But now the plane feels strange to him, though vaguely like all of them. With a watchful eye on the instrument board and the ever-mounting oil temperature, he does a series of turns that grow steeper and steeper until they are nearly vertical. Then he throttles down and practices a landing in the air, gliding down at sixty miles an hour, pulling back his control until the plane is level, and, as it loses speed, right back until wheels and tail-skid are level and the nose is up in the air. Then the nose falls, the plane dives and comes out in a glide.

Although he has been a thousand feet in the air, he has found exactly how the plane lands; he knows the right gliding angle, and the speed at which the machine is no longer flying but is settling, ready to sit down. He tries a few stalled turns, but no stunts, for this plane will not be required to stunt.

After twenty minutes the oil temperature is too high. He throttles the motor and adjusts the stabilizer until the plane is gliding for the field at a steady sixty miles, evenly balanced with motor idling. Near the ground he pulls back gently on the control until the plane is flying level, slowly settling and losing forward speed. All the time he is pulling just a little further back, turning the wheel slightly from side to side to keep the wings level laterally until the plane is just a foot off the ground, when he pulls the wheel right back until he is hugging it against his chest. The tail drops slowly and easily, and the plane settles on both wheels and tail-skid for a "three-point" landing.

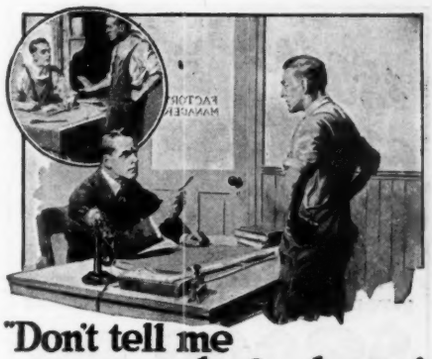
HE TAXIES to the factory doors, climbs from the big bomber, and divests himself of helmet and parachute while the executives of the factory crowd around.

"Well, how is she?"

"Fine!" he tells them. "Just fine!"

Then, in the general manager's office, intimate details are given to the manager, the chief engineer, the president. Not quite so fine now.

"Well—" the pilot fills and lights his pipe, settles back in a chair, and begins: He mentions various types of planes and touches on certain of their characteristics, comparing the way they handle and the way this plane handles. The rudder is heavier than that of a certain ship, lighter than that of another. Ailerons are hard to operate—almost as hard as those of that other type, for instance. Elevators, sensitive for a plane of this size. In short, calling upon his knowledge of types with which all are familiar, he tries (*Continued on page 132*)



"Don't tell me you never had a chance!

"Four years ago you and I worked at the same bench. I realized that to get ahead I needed special training, and decided to let the International Correspondence Schools help me. I wanted you to do the same, but you said, 'Aw, forget it!' You had the same chance I had, but you turned it down. No, Jim, you can't expect more money until you've trained yourself to handle bigger work."

There are lots of "Jims" in the world—in stores, factories, offices, everywhere. Are *you* one of them? Wake up! Every time you see an I. C. S. coupon your chance is staring you in the face. Don't turn it down.

Right now over 180,000 men and women are preparing themselves for bigger jobs and better pay through I. C. S. courses.

You can join them and get in line for promotion. Mark and mail this coupon, and find out how.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7634-E, Scranton, Penna.

Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the course *before* which I have marked X:

BUSINESS TRAINING COURSES

☐ Business Management	☐ Salesmanship
☐ Industrial Management	☐ Advertising
☐ Personnel Organization	☐ Better Letters
☐ Traffic Management	☐ Show Card Lettering
☐ Business Law	☐ Stenography and Typing
☐ Banking and Banking Law	☐ English
☐ Accountancy (including C.P.A.)	☐ Civil Service
☐ Nicholson Cost Accounting	☐ Railway Mail Clerk
☐ Bookkeeping	☐ Common School Subjects
☐ Private Secretary	☐ High School Subjects
☐ Spanish	☐ Illustrating
☐ French	☐ Cartooning

TECHNICAL AND INDUSTRIAL COURSES

☐ Electrical Engineering	☐ Architect
☐ Electric Lighting	☐ Architects' Blueprints
☐ Mechanical Engineer	☐ Contractor and Builder
☐ Mechanical Draftsman	☐ Architectural Draftsman
☐ Machine Shop Practice	☐ Concrete Builder
☐ Railroad Positions	☐ Structural Engineer
☐ Gas Engine Operating	☐ Chemistry ☐ Pharmacy
☐ Civil Engineer	☐ Automobile Work
☐ Surveying and Mapping	☐ Airplane Engines
☐ Metallurgy ☐ Mining	☐ Agriculture and Poultry
☐ Steam Engineering ☐ Radio	☐ Mathematics

Name.....

Street Address.....

City..... State.....

Occupation.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian Limited, Montreal

1000 NEEDED INVENTIONS!

Here is the most remarkable book ever offered to inventors. One Thousand needed inventions listed and described. Arranged as follows: General Problems; Automotive; Mechanical; Electrical; Chemical; Radio; Marine. Separate chapter on the Ten Most Needed Inventions. This book may give you one idea that will win you a fortune. Nothing else like it has ever been published. Compiled at enormous expense. Edited by Raymond Francis Yates, formerly Managing Editor of a leading scientific magazine. Over 100 pages, durably bound. Send no money. Pay postman only $1.00 plus postage on arrival (*Outside U. S. $1.20. Cash with Order*). Money back after 10 days' examination if desired. Limited edition. Write NOW.

BUREAU OF INVENTIVE SCIENCE
Dept. 27 Rochester New York,

$8000.00 a year is what Beck makes

"If it wasn't for you and the training you gave me, Mr. Dobe, I wouldn't be making

$8000.00 a YEAR NOW"

Lewis Beck.

$10,000 House Designed by Beck

This is but one of a great many buildings designed by Beck. He has designed schools, churches and public buildings.

Learned Drafting at Home!

Beck answered my advertisement and got my free book on Draftsmanship. That's what I want you to do now. Beck was then a helper making $12.00 a week, but he took my simple, easily understood and quickly learned course in drafting at home without giving up his job. You can do the same thing. Will you? "I often look back to the time I answered your advertisement," writes Beck, "and wondered how I could take up your course as I was not able to save enough out of $12.00 a week to make the first payment. But I finally did it and it was the best money I ever spent in my life. Thanks to your training I am not afraid to tackle any work along drafting lines and can readily master all the architect's plans."

Mail this Free Coupon or Write Today for FREE Book!

Beck asked for the Free Book first. Will you ask for it today? Certainly you are not obligated at all by writing for "Successful Dratsmanship." Get it and read it. Then make up your mind how successful you can be. This man is making real money and you know the old adage "What man has done man can do." So mail the Free Coupon below—or write a letter or a post card. Do that now. No man who is dissatisfied with what he is making now should fail to get and read "Successful Draftsmanship."

DOBE EASY DRAFTING
1951 Lawrence Ave.
Div. B-136 Chicago

Dobe Easy Drafting
1951 Lawrence Ave., Div. B-136, Chicago
You may send me free your book "Successful Draftsmanship" and names and addresses of more Dobe winners.

Name.....*Age*.....

Address.....

Post Office.....*State*.....

Broncho-Busters of the Air

(*Continued from page 131*)

to place in the minds of men who have not flown it an accurate idea of what sort of flying machine the new creation really is. Questions are fired at him and answered.

The pilot talks on: the ship is too tail-heavy, excessive vibration in tail unit, aileron balances vibrate, oil runs far too hot—never thought that oil-cooler would do the work, anyhow—motor is rough; flies right wing low—this a mere rigging detail. The engineer sighs his relief at that last one, for he knows the pilot is running out of griefs—perhaps.

After the conference those men know as much about the plane as if they had flown it themselves; that is, if the test pilot can convey his impressions intelligently, which is as important as his ability to fly the plane. For no man is more useless as a test pilot than the man who flies anything well, but who fails to discover and inform the chief engineer what is wrong with it.

Following the test flight, and after a few changes have been made, the plane is loaded to full war weight and takes the air for a ten-minute climb. The naval inspector is in the gunner's seat, with a paper on which he will note time, height minute by minute, oil and water temperatures, gas and oil pressures, engine revolutions, air speed, air temperatures.

In this and succeeding flights the pilot will climb at certain predetermined speeds until he determines the speed at which the plane climbs highest in ten minutes. Then will follow climbs to "service ceiling," the height to which a plane will climb until it fails to gain more altitude than 100 feet per minute. When it will go no highe has reached "absolute ceiling."

IT IS during altitude climbs that the skill of the pilot, or his lack of it, is apparent. An accurate pilot's climb will chart as an evenly-curved line, while that of a careless or inept pilot will chart as a line with frequent flat spots, indicating where he has failed to gain height.

After the plane has made its climbs it is put through speed tests, which are "clocked," or timed by ground observers over a measured mile or half mile. When the speed runs are over a field on the edge of a congested factory district, they offer varied thrills. In a large, heavily-loaded bomber flying at 100 miles an hour or more, the pilot has a vehicle that handles about as easily as a ten-ton truck. He must fly it just above the factory chimneys, head straight for the course on the field, and go pounding along as low as he can fly without hitting things.

Across the field he goes, and a mile beyond the last marker to turn; for the plane loses speed on turns and must regain top speed before it passes the marker on the return trip. One mile past the other marker, turn, and back again. Three times each way over the course completes the speed test, unless the plane has failed to develop the speed called for in the contract. In that case the runs must be made again and again until the speed is attained—or until the pilot has demonstrated beyond doubt that the desired speed simply wasn't built into the plane.

SPEED-TESTING over a factory district field is quite as unpleasant flying as any pilot has to do. In the event of engine failure he has only roofs, streets, or vacant lots to land on. So he sits, hoping that the engine will keep going—and it usually does. If the sun is shining from a sky filled with scattered clouds, or if a wind is blowing, the pilot must be alert to counteract the effect of severe air bumps. Flying at full speed from five to twenty feet above the course, the plane will get a bump under one wing or the tail that will tilt wing or nose to the ground. The pilot instantly moves his controls to correct this movement before a wing tip hooks the ground—at two miles a minute. And when a heavy bomber is flying fast the controls do not move easily. It's a case of quick perception and brute strength. There have been planes that none but strong pilots could fly safely.

Such, in general, is the method of testing an airplane. Different classes of machines call for different kinds of tests. A pursuit plane, for instance, must be proved capable of doing any stunt possible in the air. It must loop, roll, spin, and dive; it must "turn on a nickel" and have excellent maneuverability. For a training plane the important requirement is such stability that pupils can learn to fly in it with maximum safety.

AS EACH plane is built for some specific purpose, the pilot must conduct his tests to demonstrate that plane's fitness for the work it has to do. And, above all, he must discover every fault and pass it on to the chief engineer; for unlucky is the test pilot who passes as perfect an airplane that other pilots find to be full of objectionable faults! He will be summoned to confer with the factory powers, and after that conference he will no longer be the first man up.

For many years the testing of airplanes built by experienced engineers has been fairly safe. But the testing of freak airplanes produced by enthusiastic amateurs is a horsefly of a different color—almost on a par with leaping from the Woolworth tower clinging to an ordinary cotton umbrella.

A conspicuous example was the testing of an airplane designed by a boy of nineteen who had enjoyed a particularly brilliant career at school, and had joined the engineering staff of a motor company in England. Either the boy was a good salesman, or he possessed influential friends, for he prevailed upon the company to build a large and exceedingly ugly airplane that he had designed to break the monotony—and possibly somebody's neck. The company, it must be noted, knew nothing of airplanes, but were pinning their faith on this embryo engineer, who had received considerable publicity, and who was generally referred to as the "Boy Wonder."

AN EXPERIENCED pilot was induced to test the plane, though he consented with some misgivings. However, he taxied to the far end of the field, headed into the wind, and came tearing across the field toward where the company officials, including the Boy Wonder, were standing. The twin engines roared in unison as they dragged that remarkable airplane forward. On it went until, when it was nearly to the little crowd of observers, it left the ground and soared into the air like a lark.

Almost instantly, however, it exchanged this larklike movement for one more nearly resembling that of a skyrocket. Up to perhaps seventy feet it shot like a mad thing, its tail hanging almost vertically beneath it. Then it lost flying speed, fell sideways to the earth, and crashed into fragments.

As the company officials, who had been standing in a fear-stricken bunch within a hundred feet of where the insane machine had lit, dashed over to haul the pilot's body from the wreckage, they were relieved and amazed to see him crawl out and stand erect. He shook himself like a wet collie, and glared around him. For a moment he couldn't speak. He wasn't hurt, but he was quite the angriest man in sight.

"Where—?" he gasped at last. "Where is that Boy Wonder?"

But the Boy Wonder had disappeared.

HELP

IN A HANDY FORM

$1 A MONTH

Expert Help and **Inside Information for Builders!** Up-to-date, complete Trade Guides and Trade References—handy, pocket size; fully illustrated; easy to learn. Don't fall behind! Be a boss! Study in spare time. Send for Guides covering your trade, on free trial. Pay $1 a month if satisfied. Mail Trial Coupon Today!

CARPENTERS FOUR GUIDES $6

Audels Carpenters Guides. (4 vols. $6.) Explains how to handle every kind of carpentry job—inside or outside work. Pictures, plans, calculations and diagrams make any job easy. New short-cuts, modern methods explained. Builders and contractors questions answered. Steel Square and other problems solved. A practical Guide and helping hand for every carpenter; easy, quick methods of work that help you to be a leader.

PLUMBERS FOUR GUIDES $6

Audels Plumbers Guides. (4 vols. $6.) A standard Guide explaining the theory and practice of all plumbing, heating, steamfitting, gasfitting and sheet metal work. Answers your questions on any job. Clearly explains the new short-cuts and modern methods so you can understand. A complete reference of the Trade and home study course. Fully illustrated, authentic, up-to-date, with complete Plumbers' Code.

MASONS FOUR GUIDES $6

Audels Masons Guides. (4 vols. $6.) Every Bricklayer, Cement Worker, Plasterer, Tile Setter and Stone Mason will find the answer to his questions and problems in this series. Inside Trade information on all the latest and best practice. A Study Course and complete reference library covering the Mason's Trade; including practical outline of steel construction. A helping hand for workmen and contractors.

ELECTRICITY HANDY GUIDE $4

Audels Handy Book of Electricity. (1 vol. $4.) A reliable authority and handy helper for every Electrical Worker, covering Wiring, Radio, Calculations, Armatures, Maintenance, Motors, Batteries. A complete Study Course and Ready Reference in one handy Guide for Electrician, Engineer and Student.

THEO. AUDEL & CO. 65 W. 23 ST. New York City

TRIAL COUPON

Please mail me for *free examination* the books marked (x) below. If I find book satisfactory, I will mail $1 in 7 days on each set ordered and will mail $1 a month on each set ordered until I have paid purchase price.

☐ CARPENTERS FOUR GUIDES $6
☐ MASONS FOUR GUIDES $6
☐ PLUMBERS FOUR GUIDES $6
☐ ELECTRICIANS HANDY GUIDE $4

Name _____

Address _____

Occupation _____

Employed by _____ 7T34

PATENTS

To the Man With an Idea

I offer a most comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts, frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN
Patent Lawyer
6 Owen Building, Washington, D. C.
41-D, Park Row New York City

TRADE-MARKS REGISTERED

Answers to the Sam Loyd Puzzles on Page 65

The Cost of a Lobster

Lobsters were first sold at eight shillings per dozen, which would be at the rate of forty-eight shillings for six dozen, or thirty-two shillings for four dozen. Therefore, the cost of a single lobster would be two thirds of a shilling, or eight pence. You did well if you answered this puzzle in eight minutes.

The Grandfather's Marriage

Suppose A and B are sisters. The man in question marries A; she dies, leaving him a widower. He then marries B, who survives him and becomes his widow. Thus he may be said to have married his widow's sister, A, although she was his first rather than his second wife. If you have a good legal mind you should have answered this in five minutes or less.

The Hare and the Tortoise

The tortoise had run four and a quarter times as fast as the hare up to the time of their meeting, which was at a point where the hare had gone but one sixth of the distance of the course. Therefore, the hare now had to go five times four and a quarter times as fast as he went up to the time of their meeting, in order to finish on equal terms with the tortoise. For the distance of that spurt the hare had to go twenty-one and a quarter times as fast, or twenty and a quarter times faster, than his time for covering the first sixth of the distance. Fifteen minutes for the answer is a good rating.

The Land Speculator

The speculator bought 150 lots for $25,000 and sold them for $37,500. Thus his profits amounted to $12,500, or the original cost price of seventy-five lots. Fifteen minutes is a good record for this one.

Mysterious Card Game

The problem is readily solved by working backward. I must have started to play with $10.40. The baron put up $3.20 and the count $5.60. After the first round I had left $1.60, the baron $6.40, and the count $11.20. After the second round I had $3.20, the baron $12.80, and the count $3.20. After the third round, which the count and I won, each player had chips amounting to $6.40. Fifteen minutes is excellent.

Aunt Mary's Peanuts

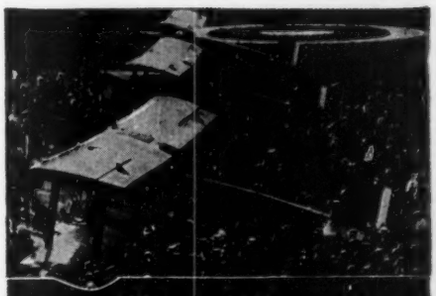
There were 1,021 peanuts. The first boy received 256; then a girl 192; then 144 to the next boy, and to the smallest child 108. This left 321 peanuts for Aunt Mary. Ten minutes is good.

Pines Draw Most Lightning

THE U. S. Forest Service has been investigating to find out what kinds of trees are most frequently struck by lightning. Pine, oak, spruce and fir, it reports, are most likely to be hit. In a study of 76,000 trees struck in the West, it was found that seventy-two percent of all that were struck were western yellow pine and Douglas fir.

High, isolated trees are especially attractive to lightning bolts, the experimenters believe. And smooth-bark trees offer less chance of being struck than those with thick, furrowed bark.

These facts are important to Uncle Sam's foresters in preventing fire hazards, for lightning causes nearly 3500 forest fires in the United States every year.



Are You Hungry For Adventure.. Popularity... Big Pay?

THEN CHOOSE AVIATION!

ARE you a red-blooded, daring he-man? Do you crave adventure, popularity, admiration, and the applause of great crowds? Then why not get into the Aviation Industry—the greatest adventure since time began—the greatest thrill ever offered to man?

Think what Aviation offers you. The praise and plaudits of the multitude. Ordinary salaries up to $75 and better than $200 a week! And a chance to get in on the ground floor where rewards will be unlimited! Aviation is growing so swiftly that one can hardly keep track of all the astonishing new developments. Air-mail routes have just been extended to form a vast aerial network over the entire U. S. Many Commercial Airlines and airplane factories are now being organized. Men like Henry Ford are investing millions in the future of commercial Aviation for they see its great possibilities.

Become An Aviation Expert!

Get into this thrilling profession at once while the field is new and uncrowded. Now—by a unique new plan—you can quickly secure the basic and preparatory training you need to get started in the Aviation Industry at home, in spare time. Experts will teach you the secrets and fundamentals of Practical Aviation—give you all the inside facts that are essential to your success. And, the study of Aviation by this remarkable method is almost as fascinating as the actual work itself.

PICK YOUR JOB

- Airplane Instructor
- Airplane Engineer
- Airplane Repairman
- Airplane Assembler
- Airplane Mechanician
- Airplane Inspector
- Airplane Builder
- Airplane Salesman
- Exhibition Manager
- Airplane Contractor
- Airplane Motor Expert
- Airplane Designer

Send for FREE Book!

Send coupon for our new, free book, just out—"Opportunities in the Airplane Industry." It is vitally interesting, reads like a romance and tells you things about this astonishing profession you never even dreamed of. Write for your copy today.

AMERICAN SCHOOL OF AVIATION
3601 S. Michigan Ave., Dept. 136-B Chicago

AMERICAN SCHOOL OF AVIATION
3601 S. Michigan Ave., Dept. 136-B, Chicago, Ill.

Without any obligation, please send me your FREE Book, "Opportunities in the Airplane Industry." Also information about your Course in Practical Aviation.

Name _____

Address _____

Age _____ City _____ State _____

Mind Reading

Astonish Your Friends With Your Amazing Superhuman "Psychic" Power

Now, for the first time, you are offered the opportunity to learn the trick of Mind Reading. You can become an accomplished "Super-Mentalist Magician", easily and quickly. Amaze your friends with your seemingly superhuman, psychic powers. Make yourself the magnetic center of every crowd.

Mind Reading only a part of the Complete Tarbell Course in Magic

Mind Reading is a vital part of the Magician's training. Tarbell teaches you the most astounding acts and the principles on which all stage mind reading is based. But in addition, you get a complete course covering the whole realm of Magic. Impromptu tricks; the science of card tricks; sleight-of-hand; and even big stage illusions; everything to enable you to become a highly paid performer. For the business man, salesman, or professional man, Magic as a "hobby" pays tremendous returns both in money profits and in social prestige.

Make $250 to $1,000 a Month

Magic has always been the most popular form of entertainment. Magicians are in great demand not only for the stage, but by clubs, churches, lodges, schools and for social affairs. High salaries are paid. Plenty of opportunity to make $25 to $100 a performance, on the side, without neglecting your regular business.

The great Tarbell course will fit you for this work. It was designed for beginners, but the profession has also adopted it for the new "kinks" and basic principles it teaches.

Mail Special Offer Coupon!

Special Offer for a Limited Time Only. You can get this great course, endorsed by the world's greatest magicians, now at a special low price. But you have to act quickly! Mail the Coupon NOW!

Tarbell System, Inc., Dept. B-136
1926 Sunnyside Avenue, Chicago, Ill.

Tarbell System, Inc., Dept. B-136
1926 Sunnyside Ave., Chicago, Ill.

Please send me your big FREE illustrated booklet giving full information on the Tarbell System of Magic. No obligation on my part whatever.

*Name*_____

*Address*_____

_____ *Age*_____

Perfect A-Current for Your Radio

(*Continued from page 62*)

dirty battery are two positive signs of neglect.

Batteries are so well made nowadays that there is little chance for acid leaks, but to be on the safe side place the battery and charger on a rubber mat or set them in a large glass tray such as is used for photographic purposes.

WHILE the six volts developed by a storage A-battery are not sufficient to cause a shock or to break down the thinnest insulation, the characteristics of a storage battery are such that even the smallest size is capable of supplying an enormous amount of current if a short circuit occurs anywhere in the wiring. If, for example, the two wires from the battery happened to become short-circuited at the binding posts of the set, hundreds of amperes would flow through the wires and make them red-hot. The temperature of the wires would keep on rising to the melting point of copper and the short circuit eventually would be broken when the wire fused apart. Naturally, anything inflammable that was in contact with the red-hot wire would be set on fire.

But there really is no excuse for fires of this type, with the correct use of a fuse. You can use special battery cable that is fitted with a fuse or you can connect a porcelain electric light socket in one of the wires leading to the A-battery, as near the B-battery as possible. Screw a five-ampere plug fuse in the socket. A fuse at this point is required by the rules of the fire insurance companies.

Your storage battery requires the addition of distilled water at intervals. If the level of the solution in the battery is allowed to get below the top edges of the plates, the exposed parts of the plates are ruined and the capacity of the battery is reduced. Large size batteries that are charged periodically by a two- to five-ampere charger require the addition of distilled water once a month on the average, but the special, small capacity batteries that are designed for use with trickle chargers have sufficient water space so that water need be added only once every six months or a year. The use of a small battery and a trickle charger also practically eliminates the need for testing to determine whether the battery is in need of a charge, although it is desirable to test the battery occasionally when you first install it to make sure that the trickle charger is keeping it fully charged. The most reliable method of testing is with a hydrometer.

Remember that your battery will be injured by undercharging and that a moderate amount of overcharging is beneficial rather than otherwise. So if you are using a full-rate charger and there is any doubt in your mind as to whether the battery is fully charged, give it a couple of hours extra to be sure. The low-rate trickle-chargers cannot injure your battery even if you do not use the set for several days at a time and the charge is running continuously.

SOME day the research engineers may produce a radio vacuum tube that will not need a storage battery to heat the filament, but if you own a storage-battery-operated set have no fear that any such development will make your equipment obsolete or that the elimination of the storage battery will improve results in any way. In fact, it probably will be many years before a set without a storage battery will be anywhere near so good as your present outfit at anywhere near the same low operating expense. The only possible advantage of getting rid of the storage battery would be to eliminate the attention required by this part of your radio apparatus, and the use of a good trickle charger and a modern battery already has reduced that particular disadvantage.

Is Your House Too Hot or Cold?

(*Continued from page 67*)

tween a snowy linen tablecloth and the problem of keeping a house comfortable in summer and winter. Yet flax is a basic material both for elegance and for insulation. It is a plant fiber of great toughness and resistance to decay. There are millions of tiny air cells between the fine long strands of the stalks, and these are multiplied by the process of felting. The substance is chemically treated to repel vermin, but there is no addition of a binder which might impair insulation value. The refrigerating industry used flax long before the idea of house insulation became widespread, and it is said that most refrigerator cars on the railroads yet employ this substance. From some of the cars junked for old age, the flax lining has been recovered in such a state of preservation that it could be used again.

FLAX is generally in quilt form of five sixteenths to one inch thickness and in various widths to fit between studs and beams or to go over them. There is also a form in which wood lath are attached to quilt by wire stitching, so that there is a ready base for interior plaster or outside stucco. An asphalt paper covers the quilt in this case, while the sizes are four by three feet and also thirty-two inches by three feet. The lath combination is made either for magnesite or Portland cement plaster or stucco.

A mixture of flax and rye straw is manufactured in board form and should be serviceable. The straw of any grain is tough, enduring and has insulating merit. Some day this fact will be recognized and millions of tons of straw now burned will be put to use in house construction.

Let us glance over the materials which, according to the Bureau of Standards, have less insulation value than those we have considered. Sawdust, the classic filling for ice house walls, has no better rank than .40, we learn. Corrugated asbestos paper is on a par with thin layers of the same and with wallboard made of stiff pasteboard, the index figure being .50. Sawdust is too loose, paste-board too dense, for the most efficient stoppage of heat flow.

BECAUSE asbestos will not burn, it has perhaps received undue popular credit as an insulator. Wrapping steam pipes with a single thickness of it prevents little heat loss. It is necessary to have many layers, a good thickness and plenty of air cells.

Cypress lumber is rated at .66, after which come, in the order of their decreasing insulation value, the following materials: asphalt roofing, fuller's earth, white pine, asbestos mill board, mahogany, Virginia pine, oak, maple, sole leather, rubber, celluloid, paraffine, gypsum plaster, and asbestos wood (asbestos and cement).

One hollow tile house insulated with corkboard has saved sixty-two percent of heating cost, according to the owner. Giving the detail figures in a recent number of the journal issued by the American Society of Heating and Ventilating Engineers, he says:

"The house is practically free from all drafts, and in summer the second floor is just as cool as the first floor, due to the insulation on the ceiling of the second floor. . . The attic is unheated, and in winter and summer has practically the outside temperature. . . The space under the roof is not insulated because the attic is used only for storage purposes."

To have an attic that may be an oven or an ice box according to season while there is a perpetual climate of comfort in your living and sleeping quarters, is certainly a triumph of the modern art of home insulation!

YOU ARE NEEDED IN TRAFFIC INSPECTION

EARN UP TO $250 per mo. salary and expenses

You can get on the payroll of a great railway company—in a profitable and permanent profession where hours are regular, and work pleasant. You will be away from desk or shop, seeing new sights and faces each minute and practically your own boss. Promotions are rapid in this healthful, dignified position.

I Train You for Traffic Inspection and on completion of 3 months' spare time home study, offer you a position that will pay you at least $120 per month salary and expenses to start, or refund your tuition. For eight years I have been training and placing men in this lucrative profession. See what they say about it.

Mail coupon today for full information

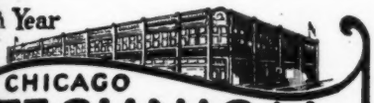
James T. Jarrell, Pres.,
Standard Business Training Inst.,
Buffalo, N. Y.

You may send me entirely free, your booklet No. Div. 3 showing how I can earn $250 a month salary.

Name.....

Address.....City.....

24th Year



CHICAGO TECHNICAL COLLEGE

LEARN DRAFTING IN 4 MONTHS

Trained Draftsmen earn $60 to $100 a week. 4 months' interesting study at Chicago Tech. fits you to earn big money in drafting's fertile field. Common schooling all you need. Expert instructors. Opportunities for self-support while studying. Free Employment Service. Day or Evening Classes. Athletics. Enter any time. Also intensive courses in Engineering, Electricity and Building. Write for free 84-page "Blue Book" and facts about how to qualify for a high-pay drafting job in 4 months.

Dept. H-910 118 East 26th St. Chicago

Chicago Technical College

If you can't come to Chicago, study at home. Write for Free Trial Lesson in Drafting.

Tire Repair Business is good now!

$500 a month

Nation-wide chain of Tire Surgery Shops now being extended to every town and city. Men handy with tools and willing to work are needed. We train you, furnish everything and establish you in a shop of your own. Small investment required. Write for interesting book.

HAYWOOD TIRE EQUIPMENT CO.
1306 S. Oakley Ave. Chicago

Free Book GIVES DETAILS

Hunters!

3 BIG ISSUES 10¢

Read Sportsman's Digest

famous hunting magazine. Hunting, fishing, trapping stories and pictures; information, tips, successful secrets on guns, dogs, tackle, all outdoor sports. Special advtg. offer—send 10c coin or stamps with name and address for 3 months' subscription. SPORTSMAN'S DIGEST, Dept. S-G, Cincinnati, Ohio.

Come into ELECTRICITY!

5 Job-Tickets FREE!

AM looking for more ambitious young fellows who want fine electrical positions paying $60 to $125 a week. If you qualify, I will first put you thru a rapid, but practical JOB-TICKET method of home-instruction in your spare time. Then I will help you get placed in a permanent, satisfactory position, or I will refund the small amount charged for your instruction. Grammar school education and good references required. *Write today.* Ask for 5 Job-tickets FREE and my combination training and job offer. *Chief Engineer Dunlap, Electrical Division.* AMERICAN SCHOOL Drexel Ave. & 58th St., Dept. E8-79, Chicago

Here Are Correct Answers to Questions on Page 45

1. Mount Lassen, in northern California. While no lava has been discharged from it within historic times, steam and clouds of volcanic dust occasionally pour from it.

2. The Mississippi, the length of which, including the Missouri, is 4,194 miles.

3. The Aleutian Islands comprise a long chain of islands running southwest from Alaska almost to Siberia. A number of them are volcanic. They mark the tops of a great chain of volcanic mountains partially submerged under the sea, doubtless by the same subsidence of Alaska that produced the Bering Strait.

4. In southwestern United States, especially in New Mexico, some of these houses are still in existence, inhabited by the Pueblo Indians. In prehistoric times there were many more of these villages. Houses three or four stories high were built of stone. It is believed that these stone villages were outposts of the ancient Aztec civilization of Mexico.

5. The sponge of commerce is really the skeleton of an animal that lives in tropical seas. The great sponge fisheries are off the Florida coast and the West Indies. Here you can see natives fish up the sponge animals by thousands. The body of the sponge is allowed to decay and the skeleton is washed and bleached. This skeleton forms the "sponge."

6. Brazil, which was originally settled largely by Portuguese immigrants. Just as North America is largely English-speaking because it was settled by the English, and just as South America is largely Spanish-speaking because it was settled by the Spanish, so Brazil has retained the language of its original settlers.

7. This famous stone is built into an ancient castle near the city of Cork, in southern Ireland. According to an ancient legend, any one who kisses it will receive the gift of fluent speech. Many a traveler has hung his head downward from the top of the castle wall so that he might reach the stone and test its magic.

8. The hippopotamus. In Africa, vegetation grows very rapidly and the rivers would soon be choked, were it not that the hippopotami plow through them, eating the vegetation and acting as a sort of natural dredge.

9. The most ancient writing of which we have any knowledge is that by the first inhabitants of Babylonia, 6,000 years ago. It is probable, however, that a crude form of writing has been invented by the ancestors of these people even before they came to Babylonia from Persia.

10. Mount Everest, highest peak of the Himalaya Mountains, northeast of India. These mountains mark the boundary between the British possessions in India and the independent Chinese state of Tibet. Mount Everest has been surveyed at 29,000 feet high. It never has been climbed.

11. This distinction belongs to the Marquesan Islands in the South Pacific, owing to their long distance from other land.

12. On the South Sea islands there lives the largest shellfish in the world. Its shell is frequently a foot or more in diameter. If a wader accidentally puts his foot on the creature when the shell is open, the shell will snap shut and the luckless individual is caught. It is said that men have been held in this way until the tide rose and drowned them.

If you want a fat pay envelope get into ELECTRICITY

DON'T be satisfied with small pay—don't be content with less than $70 to $200 a week—the money that thousands of men no smarter than you are earning. You can make it, too! It's easy! "Cooke" Training will show you how and prepare you quickly for a Big Pay Job in Electricity at $3,500 to $10,000 a year!

LEARN AT HOME—EARN SPARETIME MONEY, TOO!

You don't have to quit your present job nor lose a minute from your daily work. With my famous "Work Sheet" and "Job Ticket" Method I teach you in your spare time. Just give me an hour or so each evening and you'll be amazed how quickly you'll learn—and not only the simple things but the fullest practice of Electricity! I give you the kind of knowledge that bosses the Big Jobs and commands the Big Money! What's more, while you're still learning—in fact, only a few weeks after you start with me I'll show you how to get sparetime jobs, how to do the work and tell you what to charge. Lots of my "boys" earn as high as $25 a week this way while learning.

NOTHING LIKE "COOKE" TRAINING

If you want the Big Money and want it quickly, be sure to see what "Cooke" Training will do for you. There's nothing else like it. It's the Course with 10,000 boosters; the Course that big Electrical Companies select for their employees and that anyone who can read and write can easily master! Don't make a final move until you've investigated and found out all about this wonderful training.

IF YOU'RE NOT MAKING $70 A WEEK OR MORE—MAIL COUPON!

Right now—this very minute—act to find out why the "Cooke Trained Man Is The Big Pay Man" everywhere! Let me tell you the whole amazing story. Let me tell you about the Six Big Electrical Outfits and the many other fine services I give you without extra cost. And let me send you my Big Book of Proof, Pictures and Pay-Raising Facts. No obligation. Clip and mail coupon NOW!

I'll train you at home!

L. L. COOKE
Chief Instruction Engineer
L. L. COOKE SCHOOL OF ELECTRICITY
Dept. 3-B
2150 Lawrence Ave., Chicago, Ill.

FREE BOOK COUPON—MAIL IT!

L. L. COOKE, Chief Instruction Engineer
Dept. 3-B, 2150 Lawrence Ave., Chicago, Ill.

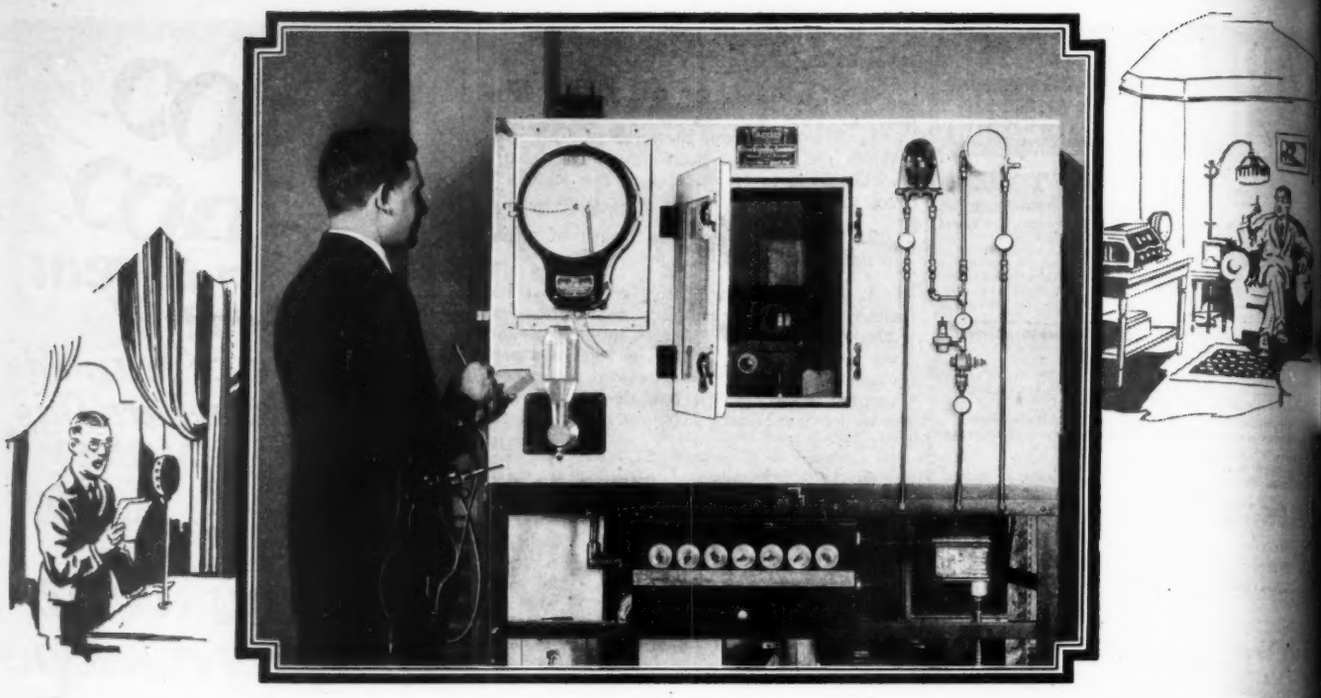
Please send me copy of your Big Book of Facts—"The Secrets of Success in Electricity." This does not obligate me.

Name .....

Address .....

City.....State.....

Residents of Canada may send this coupon to R. A. Farrow, Special Representative, 7 Medbury Lane, East, Ontario, Canada.



Tycos - the Sixth Sense of Industry in the Laboratory

Tycos for the Home

***Tycos** Office Thermometers*
An aid in promoting human efficiency.

***Tycos** Bath Thermometers*
To enable you to get the most good from your bath.

***Taylor** Home Set*
Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in Cooking.

***Tycos** Wall Thermometers*
To help you maintain a temperature in your house conducive to good health.

***Taylor** Quality Compasses*
To show you the right way in unfamiliar country.

***Tycos** Fever Thermometers*
A necessity in every home.

***Tycos** Stormoguide*
Forecasts the weather twenty-four hours ahead with dependable accuracy.

***Tycos** Hygrometer*
To enable you to keep the humidity of the atmosphere in your home correct at all times.

Tycos for the Medical Profession

***Tycos** Sphygmomanometer, Pocket and Office types.*

***Tycos** Urinalysis Glassware.*

***Tycos** Fever Thermometers.*

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above.

ARTIFICIAL weather made to order! Any weather from the freezing dry cold of Arctic regions to the steaming heat of Central Brazil can be produced in the testing box (shown in the photograph) used by research engineers to insure the quality of the receiving sets of the Radio Corporation of America.

To give satisfactory service to their users in all parts of the world Radiolas have to be made to withstand extremes of heat and humidity in all parts of the world. A *Tycos* Wet and Dry Bulb Recording Thermometer is a vital factor in making the severe tests Radiolas are put through.

Tycos Instruments for Indicating, Recording and Controlling Temperature are used by industrial as well as research engineers wherever temperatures have to be exactly measured or controlled in fractions of degrees.

Whatever you manufacture, whether delicate precision work or steel for skyscrapers, candy or furniture, textiles or tools, paints or perfumery, if your products go through heat treating processes, you can save money and insure uniform quality of production by using *Tycos* Instruments.

In the *Tycos* Line of 8,000 different kinds of Heat Indicating, Recording and Controlling Instruments, there are *Tycos* Instruments that will help you take the guess out of manufacturing. Informative literature on any type of instruments will be sent you on request. Or our engineers will consult with you on the application of *Tycos* to your particular manufacturing process.

Taylor Instrument Companies

Main Office and Factory
ROCHESTER, N. Y. - - U.S.A.
Canadian Plant: *Tycos* BUILDING, TORONTO
SHORT & MASON, Ltd. Manufacturing Distributors in Great Britain

THE ~ SIXTH ~ SENSE ~ OF ~ INDUSTRY

Tycos Temperature Instruments

INDICATING ~ RECORDING ~ CONTROLLING

This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

R. R. DONNELLEY & SONS CO., CHICAGO